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**The Role of Aerospace Power in U.S. National  
Security in the Next Quarter Century**

**Conference Proceedings**

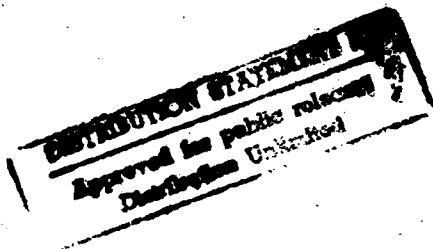
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**April 16, 1993**



**Prepared for:  
Directorate of Plans  
Headquarters, United States Air Force**

**by  
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## **The Role of Aerospace Power in U.S. National Security in The Next Quarter Century**

### **Executive Summary**

On March 16, 1993, the Directorate of Plans, Headquarters, U.S. Air Force, sponsored a conference on "The Role of Aerospace Power in U.S. National Security in The Next Quarter Century" at the Crystal Gateway Marriott Hotel in Arlington, Virginia. This conference explored what the United States can and should ask of air and space forces as central elements of the American national security establishment over the next twenty-five years. Eighty-eight individuals selected for their interest in and contributions to aerospace power participated. Speakers and attendees included representatives from the uniformed services, the Department of Defense, the Congressional Research Service, national academies and historical research institutes, aerospace industry, corporations, private institutes, and the defense press. Lieutenant General Buster C. Glosson, Deputy Chief of Staff for Plans and Operations, hosted the conference. It was chaired by Dr. Colin S. Gray, President of National Security Research, Inc. (NSR). The conference was organized and administered by NSR professional staff members John J. Kohout III, Steven J. Lambakis, Amy Bolton Moltaji, and Eva Burney.

Lt Gen Glosson welcomed participants and presented the conference's theme. Dr. Gray followed with introductory remarks that launched the conference into its first session. The conference agenda was as follows:

#### **First Session**

- Colonel John A. Warden III, Commander, Air Command and Staff College: What Aerospace Lessons should We Carry into the Future from the Gulf War?
- Professor Sam Gardiner, Independent Consultant on Warfare and Operational Art: What are the Long-Term Lessons of Aerospace History that Deserve a Leading Role in Determining How We Define our Aerospace Futures?

#### **Second Session**

- Dr. Raymond S. Colladay, Vice President, Strategic Defense Systems, Martin Marietta: *The Direction and Pace of Aerospace Technology.*
- Mr. Dick Hardy, Vice President and General Manager, Boeing Military Airplane Division, Boeing Defense and Space Group: First speaker on *Industrial Base, U.S. Relative Advantage, and the Future of U.S. Aerospace Power: Converting Economic Potential into Military Power.*

- Dr. Ronald Sugar, Vice President, Group Development, Space and Electronics, TRW: Second speaker on *Industrial Base, U.S. Relative Advantage, and the Future of U.S. Aerospace Power: Converting Economic Potential into Military Power.*

#### Keynote Address

- General Michael P.C. Carns, Vice Chief of Staff of the Air Force: *Defense Acquisition Strategy.*

#### Third Session

- Lieutenant General Buster C. Glosson, DCS Plans, HQ Air Force: *Preparing for the Next War.*
- Lieutenant General Thomas Moorman, Vice Commander, AF Space Command: *How Should the Services Fit "Space" into "Aerospace" over the Next Twenty-Five Years?*

#### Fourth Session

- Lieutenant General William E. Odom, USA (Ret.), Director of National Security Studies, Hudson Institute: First speaker on *How Much Aerospace Force is Enough for the New World "Order"?*
- Dr. Alan Gropman, Industrial college of the Armed Forces Faculty: Second speaker on *How Much Air Force is Enough for the New World "Order"?*

Dr. Gray then closed the conference with a brief overview of some of the presentation and discussion highlights and issues that need to be examined further. What follows is a summary of the proceedings, consisting of brief overviews of all papers and remarks delivered from the podium and a résumé of discussion elicited from conference attendees.

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## **Welcoming Remarks**

**Lieutenant General Buster C. Glosson, DCS Plans, HQ USAF**

In his welcoming remarks, General Glosson observed that, however great the success of U.S. aerospace power in the 1991 Gulf War, we ought to be cautious about our confidence in air power. It is important to remain in the real world, he stated, citing Sun Tzu's judgment that we must know our enemy as well as ourselves. He cautioned the audience that air power advocates must 1) realize that the Air Force should be able to do what it says it can do; 2) know the enemy's and our own strengths and weaknesses; and 3) be vocal and accurate about what they say. He closed by quoting General George C. Kenney: "History is not kind to nations that go to sleep."

## **Introductory Remarks from the Chair**

**Dr. Colin S. Gray**

Dr. Gray made a series of points in his introductory remarks.

- It is commonplace to observe that theory and technology, or theory and actual military effectiveness, finally have met for aerospace power.
- Today we need to reexamine classic air power theory as well as the proposition that that theory finally has been vindicated.
- Above all else, perhaps, it would be useful to reconsider the political and strategic merit in the 80 year old idea that air power is not successful unless it bears the promise of independent decision in war. Armies and navies are not judged failures if they do not, unaided, deliver victory. Why should air forces be expected to win wars on their own?
- Thinking of American military performance in the air, the course of 73 years (1918-1991) saw the full-scale transition from air power as a "useful adjunct" to the great ground offensive by the AEF against the German St. Mihiel salient in 1918, to the Gulf War of 1991 wherein U.S. and Allied air power plainly was the "key force" to which all other force elements were adjunct, supporting, or otherwise supplementary.
- The increase in relative potency of first-class air power over nine decades should not surprise us. The operational and strategic effectiveness of professional navies and armies has increased, decreased, and sometimes increased again over the past 400 years (armies have lost, gained, and lost again, the power of rapid operational decision).
- A movie camera and not a still camera is needed. The basics of what happened in Desert Shield/Desert Storm do not leave much room for

reasonable argument. The questions, rather, pertain to what Desert Storm can and cannot tell us about the future. Every war is unique. 1991 saw a desert war waged (albeit in bad weather) against a Soviet-style enemy led by a villain from central casting with a strategic mind-set that all-but guaranteed catastrophic defeat. Nonetheless, many of the reasons why U.S. air power was so lethal against Iraq should apply to other climes, foes, and issues.

Dr. Gray then proposed a set of "working propositions" to the attendees.

1. Aerospace power has matured to the point where
  - (a) it must be significant in conflicts of all kinds;
  - (b) frequently it will be the "key force" in the military team; and
  - (c) infrequently, it can deter or win wars in the absence of much supporting action by land or sea.
2. The United States is an aerospace power more genuinely than she is a sea power. If one reads Mahan, one finds that the United States today is not well endowed with the elements of sea power, but is exceedingly well founded as an aerospace power. The United States is a great naval power and not a "natural" sea power.
3. The trend in relative advantage favoring aerospace over land and naval surface forces is mature, but is not irreversible. Beware of the fallacy of the last move. What may reverse the trends that have been so favorable for the lethality of American air power are not only technical changes, but shifts in the political and strategic context.

#### First Session

##### Colonel John A. Warden III, Commander, Air Command and Staff College

Colonel Warden focused on the question: "What aerospace lessons should we carry into the future from the 1991 Gulf War?" He called Desert Storm the first manifestation of the first true military technical revolution. Up until the Gulf War, wars could be characterized as sequential steps taken to break through or defend a line. Hence, there was a premium on massing large numbers troops and equipment to build the required concentration for accomplishing these objectives. New war, he stated, is not sequential. It is best characterized as being "parallel." Parallel war means striking simultaneously a significant portion of the enemy's strategic and operational level assets. In such a war, the concept of the line no longer expresses a principle of war. Instead, whichever country possesses precision weapons, stealth technologies, a capability to bring war to the enemy in parallel fashion, and a sound understanding of enemy strategic and

operational organization is thereby capable of acting decisively and successfully in the theater of operations.

Colonel Warden's second major conclusion was that, while we may not be able to carry many tactical lessons away from the Gulf War, the strategic and operational level lessons promise to be generally valid. He argued that there were roughly twelve major and enduring lessons for practitioners of parallel war to be found in "the highest levels of strategic or operational abstractions". There also are lessons coming out of that war for any potential enemy of the United States. Colonel Warden argued that while tactics may differ, these lessons are "equally applicable to states, criminal organizations, and non-states." He also argued that if these lessons are to be operationalized, it must be accepted that a revolution has taken place. He cautioned that we must beware of doctrinal rigidities and parochial attachments to weapon systems and that we must fight the centralization and bureaucratization of ideas.

Colonel Warden concluded that the new force structure ought to capitalize on precision weapons, for greater accuracy will offer even greater productivity per dollar expended. A force structure should be designed to thwart new attack concepts developed by those who can no longer depend upon the principle of mass for military success and also focus on forces that can execute rapidly and with minimum lethality for both sides. Finally, in an era of reduced budgets, we must look for commonalty among civilian and military requirements and technologies.

#### **Professor Sam Gardiner, Independent Consultant on Warfare and Operational Art**

Professor Sam Gardiner's speech was entitled, "Planning for the Next Quarter Century: What in the World is an Air Force to Do?" He argued that planning for the future, having to make decisions in a changed and changing world, is a dilemma. Just because we are unable to accurately define future conflict, though, does not mean we cannot begin to understand its possible characteristics. Understanding these characteristics will allow us to draw conclusions about the future Air Force.

History tells us that war is the norm, and that we should plan for it. Professor Gardiner pointed out the difficulty of even beginning to do this. The reasons for war are many and varied. Identifying our national interests has not worked well in the past to tell us in which wars we would be involved. Nor does it appear to pay to look at national strategy for hints about the future, for even strategy could change many times during the coming years.

It is important to note that the character of war does not change in a linear fashion. Rather, war is paradoxical, meaning that the same action does not always lead to the same result. Understanding what to plan for often will mean understanding that linear changes in technology can lead to nonlinear, or discontinuous, changes in the character of war. What are the bounds around the possible futures? According to Professor Gardiner, this in part is accomplished by understanding the changing character of war, that is: the objectives of war; the reduction in the size of military forces around the

world; that not being forward-deployed changes the way wars unfold; the evolving impact of information systems and that information more and more flows from top echelons down to units; that greater accuracy and enhanced warheads mean increased weapons lethality; that the ranges of weapon systems have been increasing; and, finally, that the proliferation of weapons of mass destruction is increasing.

One also may look to trends that were evident before the changes took place in order to plan for the next war. The trend in campaigns is away from the 15 to 20 days of decisive combat previously envisioned in Europe toward a kind that is similar to what took place in Desert Shield/Storm. Also, Army, Navy, and Air Force systems, owing to their increased ranges, have become more interchangeable. Units are becoming more fragile, especially given the reliance on information systems. The tempo of operations is becoming faster because information can be processed with greater speed and ranges are greater. And finally, owing to the increased lethality of weapon systems, the density of the battlefield has been going down, which has led (paradoxically) to fewer per day combat casualties.

Professor Gardiner then pointed out that one cannot look only at trends, that to understand the impact of changes one also must look at the discontinuities that have developed. These discontinuities can affect the trends, and one, two, or more trends can create a discontinuity. He pointed out, for example, that putting together the trends of range and lethality should force us to think in unconventional ways and understand that we are no longer on a continuum. One resulting problem is that "wars have a tendency to use up doctrine and weapons. Enemies adjust. Enemies learn." Such is the paradoxical logic of war.

A fragmented battlefield, one of low density, can be expected to have a debilitating effect on traditional warfare maneuvers and concepts of leverage. War may become non-continuous, wherein commanders can refuse to give battle (or act at all on the battlefield). A commander may decide the tempo of warfare. Logistics too may be made simpler as units learn to move with their basic load being their battle load (a situation wherein resupply might only consist of food and water). A fragmented battlefield (where ground units are dispersed) may also make proliferation less of a problem by rendering nuclear weapons less useful in battle. The bottom line is that in the post-Desert Storm world, these discontinuities can make it more difficult for the Air Force to influence the immediate ground battle and to fight limited wars through conventional strategic bombing.

Countries may choose to respond to U.S. choices in one (or a combination) of four ways: parallel, direct counter, passive counter, or asymmetric. The character of warfare will change slightly depending upon how the enemy chooses to respond to developments in the United States. For example, on a fragmented battlefield, discontinuous battle will look attractive to the technologically inferior side. Passive (dispersion) or asymmetrical (e.g., special operations) responses to U.S. capabilities and doctrine would make the battlefield target-poor. Ultimately the lesson will be that "if you can't match the United

States' developments, you can end up with greater military power if you move along another path."

The strength of air power, Professor Gardiner noted, is flexibility. Perhaps the Air Force will do best to go beyond its conventional understanding of flexibility and consider an expanded or even different version. There needs to be "concept flexibility," or recognition that the ways of fighting the last war are almost never appropriate in the next. There needs to be "system flexibility" (possibly building systems to change and perform multiple roles), because such will allow the Air Force to be flexible. There may need to be "unfolding flexibility," or that quality of readiness that unfolds as the future progresses (i.e., an investment strategy, seeing readiness as a long-term quality). An finally, there should be "intellectual flexibility," that idea of being mentally prepared for an unpredictable future and viewing planning as a teaching function. "Preparing the Air Force for an uncertain future demands giving new meaning to the flexibility of airpower."

### *First Session Discussions*

Colonel Warden disputed Professor Gardiner's contention that future war will be focused on the battlefield, because the battlefield has disappeared with the emergence of parallel warfare capabilities. Second, the dispersal that does take place on the battlefield can only go so far before operational effectiveness of the units is severely weakened.

An objection was raised in the audience that not enough attention was given by either speaker to the fact that offensive advantages often lead to the development of defensive advances and vice versa. Should American air power become vulnerable, we will not be able to project power across the oceans or push inland into Eurasia. What are the long-term implications of the revolution that both speakers have talked about? Professor Gardiner pointed out that you need to separate the operational advantage from the tactical advantage. There may an operational advantage to an enemy to going early against the United States, and then going on the tactical defensive. What will that do to U.S. policy? Indeed, whether or not one takes the initiative is probably more important than making a distinction between offense and defense. Colonel Warden reemphasized his belief that no country will be capable of invalidating American offensive power in the foreseeable future. In the longer term, it will be up to us to make sure that we maintain those offensive advantages if we are to avoid isolation on our continent.

Another observation was that our real objective is to influence the enemy's perception against fighting the United States. Professor Gardiner concurred with this point and recalled the profound effect that the concept of the Follow-on Forces Attack (which focused on the employment of air power) had on the Soviets and the Warsaw Pact and their doctrinal writings. What we write and think can have a profound effect on people. Hence, we could openly work on systems that would be effective on a low-density battlefield (or develop a doctrine for using tactical nuclear weapons) so that we may

never have to fight that kind of war. We need to stay one step ahead by thinking about the reaction.

One fear expressed was a repeat of the weakened U.S. military position that followed post World War II downsizing. Also, the idea that "jointness is equality" and the fact that the services (backed by strong institutions) seem to be fighting against the reality that things in the world have changed are negative trends. This means that despite all of the technical advantages of the United States, we still may find ourselves in a difficult position. Professor Gardiner, concurring with these points, reminded the audience that fundamental changes in doctrine more often comes on the heels of wartime losses.

It also was pointed out that the United States needs to be prepared to deal with new nuclear states, and the subject of the North Korean nuclear program was raised. Colonel Warden stated that we need a doctrine for using tactical and/or strategic nuclear weapons. Nuclear weapons, he stated, without question would be used in a strategic role and not in a limited manner on the battlefield. The United States needs to go beyond the policy of deterring the use of nuclear weapons to one of preventing the use of nuclear weapons (e.g., preemption). Professor Gardiner said that we also need to think about punishing the user of nuclear weapons. The United States may not be able (for political or military reasons) to respond in a like way. We need, however, both the conventional and the nuclear option.

The point was raised from the floor that the nuclear weapon really is just a temporary substitute for precision. The same would hold true for Third World powers. The tactical ballistic missile issue will be an important one. Had Saddam possessed a number of highly accurate missiles, he may have been able to deny coalition access to essential bases in Saudi Arabia. We need to develop defenses against tactical ballistic missiles. Professor Gardiner mentioned that there are other ways to get around this vulnerability: what if the Air Force, Army, or Navy units stand off and do not give the enemy a target? We need to think asymmetrically. After all, we can respond from stand-off ranges. Colonel Warden stated that the Gulf war could have been prosecuted from more distant bases (Turkey or Egypt), and for the foreseeable future we can operate easily in any region outside the range of available missiles. Today's missiles have very limited tactical utility. They are of much greater use against strategic targets. Thus, Colonel Warden concluded, we need to have a capability and a doctrine to prevent ballistic missile countries from being successful.

Another opinion from the floor was that the Air Force needs to be careful not to disregard certain capabilities just because new ones come along. For example, just because fighters today have a missile capability does not mean that pilots do not need to be trained to fight at close range. We need to maintain ground, air, and sea forces capable of covering the entire spectrum of conflict. The balance can change, but we need capabilities across the board. Colonel Warden stated that the reality of limited resources and budgets forces the services and the Pentagon to focus much more on areas where you get the most productivity. The opinion was raised that this was why

we need a force structure that has flexibility. It needs to be asked, how will each proposed weapon systems serve across the spectrum of conflict?

Another opinion expressed was the need for the Air Force to reconsider its basing policy. There may be a greater need in the future to avoid having aircraft waiting to be manned sitting on the ramps of theater air bases. We need more reliable aircraft that will spend a minimum time on the ground, where they are most vulnerable.

The importance in future wars of having a capability that exploits mobility and allows the United States to take the initiative also was stressed. While precision weapons are very significant, mobility at all levels may be even more significant. Colonel Warden agreed and went further to state that, given that we might not always have favorable basing, we need to build an airplane that has a genuinely global capability. A global airplane would have commercial as well as military possibilities.

Dr. Gray noted that the two papers delivered really had more opposing viewpoints than the ensuing discussions revealed. He noted that Colonel Warden's idea was that the events and trends we saw during the Gulf War were going to continue. Colonel Warden's paper, unlike Professor Gardiner's, seemed to lack a notion of an active, intelligent, and able enemy determined to react to our initiatives. While Dr. Gray agreed with Colonel Warden's conclusions on a point-by-point basis, he was worried that those conclusions spare the appearance of resting upon a somewhat enemy-independent strategy. Referring back to points made by Professor Gardiner, there may be a way to get around Colonel Warden's theory of successful war. What if parallel warfare is a game that two can play and the United States is confronted by a first-class enemy. The strategic and political context will be critical. Colonel Warden responded that now and over the next fifteen years, the likelihood that the United States will be confronted by an able enemy will not be high. Also, he acknowledged that parallel warfare could work both ways, and that what we could do to an enemy, a competent enemy could do to us. If an enemy can reach our strategic centers of gravity, and if they attack first and air superiority is lost, then the United States probably has just lost the war. The capability of moving first becomes an extraordinary military driver.

## Second Session

Dr. Raymond S. Colladay, Vice President, Strategic Defense Systems, Martin Marietta

Dr. Raymond S. Colladay addressed the direction and pace of aerospace technology. He noted that American industry—including the aerospace-defense industry, which also must deal with a downsizing trend—has been undertaking dramatic modernization programs to become more productive and competitive in the global market. In an era of expensive and long-leadtime development of weapon systems, how we do things is going to change more dramatically than what we do. If we are to continue to improve quality and drive down costs, there will have to be continuity of activity that minimizes work stops, cancellations, stretch-outs, and low-rate production.

Today, there seems to be a diminished will to finish programs. Any program that exceeds four years will require a lot of political capital to see it through. Many systems, like Brilliant Pebbles, have to be produced instantly to avoid becoming a political target. Concurrent engineering (where things need to be done right the first time) may be one approach for addressing some of these problems. With virtual reality—which allows products to be simulated, modified, designed, and then produced—concurrent engineering may be taken to new heights over the next twenty-five years. We should carry the "silver bullet" technologies to the point of building operational prototypes that can be fielded and evaluated.

Industrial operations will need to move fully into the information age by collecting data, fusing it, converting data into information, and disseminating it in a timely and highly leveraged way. In this way, systems can be made more effective. Information can go to neural network computers that will enable more capable autonomous weapons and unmanned vehicles. "Smart, precision weapons will become brilliant as electro-optical sensors increase their spectral domain and on-board processors achieve teraflop speeds in sizes smaller than a soup can."

Progress in miniaturization will allow for the development of a whole new dimension in control systems' critical processes, fluid flow stability, and robotics. The development of small satellites also will benefit, making for a more cost-effective approach to distributed surveillance. Miniaturization has led to much progress, for example, in the Brilliant Pebbles program. Dr. Colladay noted that we have the technology for deploying affordable ballistic missile defenses, but we are no closer to realizing it today than we were ten years ago. Indeed, the SDI program is faltering because of a lack of political will to act. Speaking as a citizen concerned about future U.S. vulnerability to missiles and as an aerospace engineer frustrated by political impediments, he said there was a dire need "to get on with it."

Dr. Colladay also warned of the misperception that technology can be put on the shelf until it is needed. In reality, the shelf-life of many technologies is two years. The resurrection of databases, technical expertise, and materials is very difficult.

Industry and government need to come to some consensus about planning, budgeting, the procurement process, and oversight, or else the next twenty-five years could present significant troubles for both. Dr. Colladay concluded by saying that he was confident that the acquisition process will be streamlined, aerospace industry will be "right-sized" and profitable, and that technological breakthroughs will occur to take us in exciting directions. He closed with a thought on the subject of making projections twenty-five years hence: "Things are more like they are now than they ever have been before—and ever will be again!"

**Mr. Dick Hardy, Vice President and General Manager, Boeing Military Airplane Division, Boeing Defense and Space Group**

Mr. Dick Hardy then took the podium to talk about the industrial base and the future of U.S. aerospace power. Both industry and government are struggling to maintain U.S.

advantages in aerospace power while reducing the size of the armed forces and the industrial base. The real questions are how should this reduction occur and what actions will help us retain capabilities critical to national defense.

Currently, the aerospace industry, like other defense industries, is undergoing reductions in industrial capacity; it needs to increase efficiency and maintain production viability. Controlling overhead in the face of program cancellations and stretch-outs is the immediate challenge to industry. Industry will have to meet the challenge and will be expected to meet contractual commitments. The government must continue to support technology growth if the United States is to continue to field decisive combat capabilities. As forces reduce, technologically superior weapons will grow in importance.

Government and industry must resist the temptation to move in the WPA (Works Projects Administration—"make work") direction. This will throw the defense industrial base off track. Market forces should be allowed to work and to determine the size and composition of industry; government relief for industry should be minimized. There should be no sustaining contracts for unneeded goods.

Government can help by making research and development profitable. Where there is technology development risk, fixed price contracts should be abandoned. In an era when there will be fewer and fewer large production runs, there should be an R&D environment that encourages technology growth and spreads some of the risk to government. Otherwise, industry investments are skewed and a fair return on capital denied. The government must try to pay its bills on time and insure that the acquisitions community does not encourage "buy-ins," which generally result in downstream cost overruns, schedule slides, and recriminations. These steps will help future programs.

Government also should recognize that its extensive oversight activities place undue burdens on industry and are of negligible value. The oversight procedures harm industry, which must commit up to five times as many finance people per dollar of sale on government contracts as on commercial contracts.

The specification and paperwork requirements associated with development contracts should be reworked to lower the cost of prototyping and developing new systems. Under the "rollover plus" concept, for example, many new Engineering and Manufacturing Development (EMD) programs will not go into production. Industry currently is using different techniques to improve the baseline and designing quality products and processes. Very few government reporting requirements add anything of real value to the actual design process in an EMD program.

The acquisition of commercial products to meet military needs also may offer significant efficiencies and savings. Government accounting requirements and audits, however, add unnecessary time and cost and are significant obstacles. Mr. Hardy added that "many government acquisition officials are afraid to give up the crutches of military specifications and standards."

Industry must do its part to recognize the shift in military requirements (toward, e.g., accurate conventional weapons, better reconnaissance, and a reliable, low-cost space launch capability) and adapt appropriately. Industry would like to see "solid, value added programs which meet Air Force fundamental mission needs," like new attack aircraft, precision weapons, advanced avionics architectures, and theater missile defenses. These future programs, started purposefully, will help size the industrial base in the most economically efficient manner. It also should be noted that there will be synergisms between military needs and civil programs, meaning that technological advances will have shared benefits. Mr. Hardy concluded by encouraging the Air Force to pursue joint programs with U.S. allies, because this would expand the market for the industry's product and the resources available to support development.

**Dr. Ronald D. Sugar, Vice President, Group Development, Space and Electronics,  
TRW**

Dr. Ronald D. Sugar then delivered some policy recommendations for industry's role in the maintenance of U.S. aerospace superiority. Dr. Sugar began his remarks by suggesting that it is more accurate to say that we are now in an interwar period, not a post-Cold War era. U.S. aerospace elements must be prepared for what comes next. This will mean reliance on systems that are CONUS-based and smaller, lighter, and more mobile. Education and training will grow in importance and we will increasingly rely on high technology and space-based force support and force enhancement systems.

The current political, economic, and bureaucratic climate, however, will challenge the ability of the industrial base to provide these systems. Industry has capacity far in excess of what is needed to handle the declining number of programs, and this will hurt industry profits and operational efficiency. Industry must undergo permanent restructuring, which may be a perilous process given the poor past performance record by the United States when downsizing its industrial base. After every past restructuring or reconversion period, the United States has found itself unprepared to deal adequately with world events.

Aerospace industry (and not just the National Labs and Federally Funded Research & Development Centers—FFRDCs) must be ready to produce the weapons necessary to enable force multiplication and projection and to maintain information superiority. It also must be healthy in order to sustain U.S. economic strength and global competitiveness.

Dr. Sugar made the following policy recommendations.

1. Spending must be reduced in an orderly way to maintain economic viability of industries and minimize dislocations.
2. Release the forces of progress by downsizing the large government bureaucracy.
3. Do not nationalize the industry by shifting R&D, production, and maintenance activities to government labs, depots, and FFRDCs.

4. Streamline and restructure the procurement systems to meet the realities of the 1990s.
5. Overhaul DoD laws, regulations, and practices.
6. Stimulate U.S. industrial competitiveness through tax, trade, and regulatory policies.
7. Given that there will be fewer large production runs, government needs to guarantee continuing capital investment in defense systems by ensuring fair returns on RDT&E work.
8. Maintain an adequate, stable production base, including subcontractors, suppliers, and vendors to ensure the development of future prototypes.
9. Encourage dual-use commercial applications of defense industry technologies by reducing regulation and oversight where applicable and assist U.S. industry in exporting.
10. Be wary of the health of certain centers for excellence for military-unique technologies when making future procurement decisions.

#### *Second Session Discussions*

The first question from the floor asked the panelists how they rated the potential threats of the Western Europeans, Japanese, Russians, and the Chinese to the U.S. share of the aerospace market. And then, how would the quality of those foreign products match up to U.S. standards? Mr. Hardy remarked that the U.S. launch industry is in very poor competitive shape, worse than the oil or steel industries. Our cost to put an object in orbit is greater than the competition, and this is before the Russians have really come into the market. Despite the fact that the U.S. will have a significant quality edge, we also can expect the Russians to swamp the market with their airplanes.

Dr. Sugar noted that in the space area, foreign governments have chosen to subsidize these industries for reasons of prestige (be it technology- or military-inspired). France is the most aggressive competitor in the space field, and it is very interested in improving surveillance and communications capabilities. In the Far East, the country to watch is Japan, which is likely to play a much more significant space role over the next ten years. Japan already has a significant technology base and it is not likely to want to remain just an economic power and a "military light-weight." Positive developments in the space area also can be expected in Taiwan and Korea.

Someone else observed, "well, what should we expect?" We have not developed a new launch vehicle in over twenty years, and our current line of expendable launch vehicles are ICBM-technology-based. We have been unable to get our act together to develop a cost-effective launch vehicle for the country. This is something that we can do and that

requires a concerted cooperative effort on the parts of government and industry. Changes in the payload requirements may well force this change.

Dr. Gray then posed the question a different way. How unique is the U.S. industrial base; how American is it; and how American can it remain? One answer given is that it varies according to the area. For example, the United States has a very unique technological position when it comes to fighter aircraft. Dr. Sugar stated that the United States was still unique in the space area, although he was concerned about where the United States will be five years from now. We have to be concerned about our commercial competitiveness (and the foreign subsidizing of aerospace industries) as well as what we do with our innovative technologies.

Dr. Colladay asked the question another way. How easy would it be to reconstitute our aerospace industrial base once it is lost? Given the present acquisition system, the barriers to entry into this business for new companies are enormous. We must downsize, but we must be sure that it is healthy and that it is done right. Mr. Hardy noted that, with regard to fighters, the United States has maintained the industrial base because it developed new aircraft programs at regular intervals of just a few years. Now we are looking to develop fighters every ten or fifteen years. This will not help maintain the base or our military capability. We need to begin new programs with the understanding that some of them may not go into production.

Another point raised was the tension between the need to maintain technological superiority and the need to increase foreign military sales (FMS). Weapons procurement people in Air Force operations routinely agonize over the issue of FMS: what balance do we want to achieve when we are concerned about maintaining a qualitative edge? Between the sale of weapon systems, some of which are not even in our inventory, and the issue of technological superiority, how do we choose? Mr. Hardy stated that, while we do make mistakes, we can do joint programs with our allies wisely. It is important, first, that we pick the right allies. We also can make decisions by distinguishing between high and low technologies. In the low technology area, there is a lot of room for negotiation. It will take judgment when it comes to more sensitive technologies. But we need to keep the industry profitable if we are to avoid nationalization and possibly even collapse.

Dr. Gray remarked that picking who will be our allies twenty-five years from now is not an easy task. Who will be aligned with whom in the year 2018? This is a vexing problem when one considers how long it takes to bring a new airframe, for example, into production.

Another in the audience noted that the acquisition process has become unduly arduous. He noted that it takes up to 144,000 man hours just to produce documentation to get from one milestone to the next on a single system. Mr. Dick Hardy's idea for a lot of new starts is somewhat at odds with the whole concept of "Milestone 0," which holds that before you can begin developing a system you have to prove that you need it. How can the process be adapted to keep the system healthy?

Mr. Hardy wondered what could be done practically to improve the acquisition system. Generally, the way things work, you have to wait until things become catastrophic before there is movement. Regulation during this time probably will increase to the point of gridlock—and then we will have to start all over again. Dr. Colladay noted that the industry has to share some blame for this situation. He hopes that the Defense Department and the acquisitions people will take advantage of the current downsizing in the industry. There is such pressure to become cost-effective and efficient that, if the government does not muck it up with overregulation, the government will derive the benefit of downsizing. The industry, which is two to three times over capacity, will become more competitive, so that if the acquisitions process gets streamlined at the same time, we can solve the problem.

The question was then asked whether this overcapacity could be reduced by shifting all work done at the National Labs and Depots to private industry. Sugar thought this was a rather extreme measure, but that it was a direction that we need to consider if we are going to maintain the industrial base and avert national disaster. SETA\* -type work will keep important industries and their engineers on the playing field.

Dr. Gray noted that the industry's viewpoint was well represented on the panel, but that of the uniformed or customer perspective was not. He then invited comments on the aerospace/industrial problem from the uniformed people present. The point then was raised (by a non-uniformed member of the audience) that we need to look at these issues in terms of requirements and then systems, and that those in the Air Force that were present should take these ideas about eliminating all of the non-value added activity back to the acquisitions people. The acquisitions people will be responsive to what the operations people and the CINCs have to say. Acquisition has to be just as efficient as war-planning.

Someone in the audience then pointed out that the Air Force never really has had a paradigm for the acquisition of systems. As the Air Force considers future acquisitions, and the C-17 was mentioned, it needs to think more about marketability in the world as well as the capability to perform the required missions. This will help reduce R&D costs and improve U.S. global competitiveness.

A question was raised about Mr. Hardy's ideas for new starts in programs, and whether he meant primarily modernization. Hardy said he meant to stress new starts. Modernization would help maintain only some industrial capabilities. We need the capability to produce and apply the technology that goes into a total system, and prototyping will help maintain it by forcing the industry to come to grips with the multiple problems that arise during development.

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\* Systems and Engineering Technical Assistance.

## Keynote Address

### General Michael P.C. Carns, Vice Chief of Staff of the Air Force

General Michael P.C. Carns presented thoughts about a possible future acquisition strategy intended to help preserve the U.S. industrial base. The perception in the military today is that while we are in a period of change, we probably can manage with some modest modification to the existing procurement/ production system. General Carns disagreed with that assessment.

The present force and military-industrial base was built on the foundations of World War II and the sustainment of the Cold War. This system was typified by large production capacity, high volume production, rapid technological development, swift activation of weapon systems and equally swift retirement once we had a follow-on system. But times have changed. We no longer face the threats we once did; our weapon systems are superior for the near term; and resource demands to solve domestic problems are very intense. There is significant risk to sustaining a viable and credible military through this period. Our fighting force structure is getting old, and resources are thinning. It is not certain that some of our current production runs for modernization will be completed. New thinking is needed to enable the armed forces to continue to provide security and to ensure U.S. engagement abroad.

Do we sacrifice force structure to finance some of the more expensive systems required for force modernization? Or do we sacrifice modernization? A change in thinking is required to solve this dilemma. The military needs to change its concept of modernization and think of it in output terms (i.e., squadrons per year) rather than per unit cost. Industry must change by shifting from large capacity, high volume, tight runs (with expectations of follow-on contracts that make a company decide to retain that expensive and large capacity) to a sharply scaled-down capacity, dramatically reduced overhead accounts, and smooth production that operates high on the learning curve. This will stabilize production runs so that purchases will take place over decades rather than years. It will help guard against periods of sharply reduced orders and industry closings owing to the lack of follow-on work. It will help preserve force structure and a capability to modernize.

There is a corollary to this in the sustainment section. We would be procuring at a lower rate, and at the same time sustain the existing systems. Our depot system is substantially overcapacity. Rather than maintaining the congressionally mandated 60/40 split between Defense Depots and Industry, we should consider taking off the shackles and subjecting the system to competition, putting it on a commercial basis. Industry then would be able to size consistently with what they are able to buy into.

If we take this kind of an approach, in the case of the Air Force alone, while we would have reduced-rate production, you would see at least three systems in long-term production for the next several decades. If you include Navy requirements, we could easily sustain five to eight hot lines of production. It would allow the president to

revitalize the domestic sector; it would support the congressional commitment to support defense conversion; it would support the Secretary of Defense in reshaping an acquisition strategy and nurturing new technologies; and it responds to the CINCs and services needs for military readiness and sustainability.

This plan would allow us to maintain a capable force at the lowest cost. It links technology, modernization, force structure, and the industrial base into a cohesive and cooperative framework. It offers industry a predictable and substantial primary production, and it cuts sharply up-front acquisition dollars and drives savings into maintaining force structure as well as satisfying domestic priorities. And finally, it provides the United States with a solid reconstitution base.

### *Discussion*

One point raised from the floor was that, in the past, stretching out a program usually was a driver of the unit cost. Would not the lengthening of programs increase the costs of systems? General Carns restated his point that the idea is to flatten the process and size the process commensurate with the output. Economies of scale will be an issue, but the proposed system will have reasonable costs and it will provide stability to the industrial base. No doubt, industry will be challenged by this program. The biggest problem now, though, is up-front money, and if we cannot find it, we will have to consume force structure.

What about the recovery capability of the United States in time of war? General Carns answered this question first by stating that the United States was for now and the foreseeable future the preeminent power. The United States, moreover, would have five to eight hot lines of production to turn to and that could be ramped up quickly in the event of a global threat. We should have plenty of industrial base to respond. The only alternative is cold lines resulting from lack of follow-on work to major systems.

Dr. Gray then suggested that if these changes were made in the acquisition system, it would be the first time in history that such changes were made in an orderly and responsible way. General Carns replied that, sure, it may not work, but that he believed that there was a strong motivation on the part of industry to accept this approach, because more will survive, and there is strong motivation in OSD and Congress to put acquisition and sustainment on a more reasonable track.

The Conference then broke for lunch.

### *Third Session*

**Lieutenant General Buster C. Glosson, DCS Plans and Operations, HQ USAF**

General Buster C. Glosson addressed preparing to fight in the next war. He began by stating his belief that history repeats itself, which means that the United States should expect to find itself in some kind of war at some time in the future, probably "in and

around the vicinity of 2010." He also believes that two major lessons came out of the 1991 Gulf War: 1) the American people developed a new level of sensitivity to casualties; and 2) America's leaders have come to appreciate the value of using military forces to dictate the terms of conflict and of not using the military force in a way that has no constraints and is at some other nation's time and choosing.

There really was only one issue in this war, and that was the price we were prepared to pay; the outcome was never in doubt. General Glosson views the challenge of the international security environment in this manner as well, for there is no opposing superpower looming on the horizon. Conflicts, however, will always be there. He then presented five challenges to the United States.

- The first challenge is the proliferation of weapons of mass destruction and advanced conventional weapons. This is a fact of life. Some seventy-nine countries have surface-to-air missiles, and fourteen countries are pursuing cruise missile technology, which can be used to deliver NBC weapons.
- The second challenge is the rapid advances now being made in technology. We now are able to kill more accurately, more quickly, and more economically.
- The third challenge is the leadtime it takes to bring new technologies to fruition. It is still quite mind-boggling. In 1993, for example, some 1970s technologies are just now coming into play.
- The fourth and most pressing challenge is the declining defense budget.
- The fifth and final challenge is that of the security environment. Who is our next opponent? Where will we fight? And, more critically, will we have the right strategy, the right weapons, and will the people be trained with the right doctrine when it comes time to fight again?

Clearly there is room for downsizing, especially in light of our present economy. It's very hard to explain to the American people that we cannot do with less than the \$250 billion defense budget in order to defend this nation adequately. We do have to be concerned with the entire conflict spectrum, however, for as a superpower that desires to be preeminent on the world scene, we will have little opportunity sometimes for choosing where we must be engaged. The bottom line is that we, not others, must determine how we respond and when we respond, although in many cases they will determine where we respond. In any case, we must remain ready. Wishing for the best is not the same as preparing for the worst.

The challenge will be in weapons procurement for use in the future, what to buy, how much, what capability, how do we train our people, and upon what strategy and doctrine do we base everything else? Flexibility is very important. Educating and training people is critical. In many ways war is managing chaos. We have to be able to

fight along the conflict spectrum, even simultaneously at the extreme ends. Flexibility will be the key to our future

But even if we have the best weapons and the best-trained forces, the initial political decisions made before and during the early stages of conflict will be overriding, as was proven in Vietnam. Moreover, wars cannot be won on the ground or in the air until first they are won in the minds of the commander. Saddam Hussein was out-thought long before he was out-fought. General Glosson then quoted Jimmy Doolittle who said that if we have to fight, we should be prepared to do so from the neck up instead of the neck down. Intellectual activity, which builds our doctrine, is what we are all about, not numbers.

General Glosson also stated his belief that the development of Air Force doctrine is the most important thing that can be done. Doctrine is the key to every decision made about air power. Many of the poor ideas of the past (such as "the bomber will always get through" and "bombing cities will break enemy morale") were not based on a solid doctrinal foundation, proved to be ineffective, and cost the lives of many people. Joint cooperation, the involvement of all the services (recognizing the part of the force that is able to do the job), will be required to establish what is the best way to go about fighting a war.

What will air power contribute to war? This is unclear, but we do need to continue our search for new methods for projecting military power. These methods should limit our exposure and limit the loss of life as well as the number of enemy casualties. We need methods that can respond quickly to crises and deliver a punishing, accurate, and sustained response. We need methods that we can employ as we dictate. We need to retain our vision of the future, for we will need the political backbone to make the right decision up front. Otherwise the best weapons, doctrines, and soldiers will be to no avail. The American public needs to be educated to these points.

Dr. Gray responded to General Glosson's speech with some brief remarks about the growing complexity of war. War in the beginning of this century was relatively simpler than it is today. It was two-dimensional: the land and the sea. Defense planners today need to think about what balanced joint planning and operations mean. We have to think more about coordination, combining land, sea, air, and space.

#### **Lieutenant General Thomas Moorman, Vice Commander, AF Space Command**

Lieutenant General Thomas Moorman then took the podium to speak about how the services should fit "space" into "Aerospace" over the next twenty-five years. The gap between air and space components, he began, is fairly wide for a number of reasons, "not least of which are the tremendous success and effectiveness of modern airpower." Technology demands, the high costs of accessing space, and cultural and organizational barriers provide additional reasons. Only now, with the experience of Desert Storm, have we developed a better appreciation of how valuable space is for national security.

The development of a truly aerospace doctrine and a better understanding of space at the senior levels have helped us to turn the corner with regard to space.

It is important to think of the integrated applications of space and air, because "aerospace power" multiplies the effectiveness of both components. First, space enhances the speed, range, flexibility, precision, and lethality of air power. It also assures command and control at the tactical level, which can improve timing and synchronization of operations and allow the United States to dictate the timing and the tempo of war.

Space also is an important source of information in combat as well as the important means for manipulating that information for best advantage within the theater. In a future war, updating our information about the theater to reduce the uncertainty of the battlefield will be a critical task for U.S. space systems. Their missions will include furnishing new information on pre-selected targets, deploying a communications terminal architecture, providing up-to-date maps and navigation data, and delivering to the theater CINC and individual pilots real-time situational awareness. The challenge will be to get the right information to the right recipient in a timely fashion. Space forces will allow the United States to understand the battlefield better than the enemy and then exploit that advantage to the fullest.

Space and air power allow the armed forces to meet the growing expectations of the American people to be able to get to a given theater with sufficient force quickly, do the job, and then get out with minimum casualties on both sides. Space forces will increasingly lead the effort by predeploying intelligence, communications, navigation, and attack warning infrastructure from a position of safety. Space forces also enable more cost-effective air, land, and sea forces by providing the required information infrastructure, reducing the need for dedicated terrestrial "capabilities in being."

The other part of the space vision is the concern for understanding the overarching geopolitical and strategic contexts in which planning will have to take place. Enormous geopolitical changes over the last few years have set a boundary of conditions for our future forces, meaning that we are likely to see the need for smaller size, CONUS-basing, and lighter and more mobile forces. Space forces also will contribute significantly in any future U.S. strategy, which is likely to include continued nuclear deterrence, ensuring stability in Europe and Asia, and a new focus on regional interests and conflicts.

General Moorman stressed that in order to realize space's potential, the defense establishment must embrace military space power. The first step in this assimilation and acceptance process is now taking place in the Air Force, especially in the area of education and training. The Air Force also is spearheading an effort to build the doctrine and the aerospace power strategy to employ space forces. The Air Force, he said, is "committed to being a responsible and dependable steward of America's military space program."

At the user's insistence, greater consideration is being given to the theater and tactical applications of space. One of the areas of most concern to DoD officials today is the proliferation of ballistic missiles. The Air Force is committed to deploying the Follow-on Early Warning System, which will allow us to see theater missiles better. This system very likely will be capable of processing threat information on-board satellites and linking it directly to the theater. Ultimately, space will have to play the key role in ballistic missile defense by cueing ground defenses and becoming part of a layered defense system that includes space-based interceptors.

Finally, our growing reliance on space translates into a growing need for space control capabilities. Despite the fact that the United States has no match in space, other countries see the advantages of exploiting this medium and can be expected to develop forces and systems capable of doing the same. Will space be used against the United States in the next war? The United States needs to develop ways for controlling space, including the capability to deny an enemy the ability to use space against us.

### *Third Session Discussions*

The question was raised whether or not specific policy and international legal hurdles were being considered for the expansion of space capabilities. General Moorman replied that with regard to the broader international aspects, no they were not. In a legal sense, he continued, there are no prohibitions to activities in space save the using of weapons of mass destruction and ABM weapon systems. The ABM treaty will have to be dealt with if we move toward a more defense dominated strategy. The big hurdle will be the states of the former Soviet Union, many leaders of which still view space-based defenses with great alarm.

The point was raised by someone in the audience that several speakers have addressed the very long lead times (twenty to twenty-five years) required to bring weapon systems into the field. He also pointed out that industry has made great progress in reducing this lead-time. General Glosson responded that there is progress being made in this direction, and that the current administration is receptive to such ideas. General Glosson said that we are unlikely to see leadtimes shortened to three to four years, but a goal of five to seven years is not unrealistic. One great obstacle to overcome will be organizational and bureaucratic mindsets. Someone else in the audience noted that the best way for the military to advance the cause of shorter leadtimes is to support the prototyping process, which can be enhanced by the latest simulation and modelling technologies.

The question then was raised as to whether those in charge of space missions were thinking actively about space control. General Moorman responded by saying that the ASAT has had a very checkered history, and that the latest design on the board is an Army kinetic-energy system. The Air Force, which traditionally has led in this area, is being reenergized to focus on ASATs and some of the systems the United States might employ. But there are a host of things one can think about when one talks about space control, including the use of SDI technologies. We need to continue investment in directed-energy ASATs as well as in a tactical broad-band jammer. General Moorman

confessed that he believed that the Air Force and the other military services have not done a good job describing the threat posed by the proliferation of space technologies and the problems presented by the ability of a future enemy to reconnoiter our deployments from space.

The problem of foreign countries using GPS against the United States was posed to General Moorman. What could be done to prevent a foe from acquiring advanced missiles and guidance technologies and then plugging into our GPS satellites to enhance missile accuracy. General Moorman responded that he shared these concerns, and as we continue to develop the GPS system we will have to think hard about how we can achieve information denial and limit access to the GPS signal. The problem of ballistic missile proliferation will only get worse, and we will have to come up with a way to counter these weapon systems. We did not learn the lesson of the German V-2 rocket, which was used in World War II to terrorize London. The Scud missile poses a similar threat, and even this system is "stone age" compared to what is currently available. Consequently, we are going to have to place much more of an emphasis on missile defenses.

Another opinion voiced was that the Air Force should invest purposefully in those systems that allow us to exploit space much more than we plan to do. The Air Force, he stated, should break away from this paradigm that you have to have a fighter-pilot in the seat of a cockpit to accomplish many of the Air Force missions. General Moorman suggested that the Air Force was on its way to doing just that. The question is, how do you take this technology and apply it to Air Force missions better? We are entering a phase where we should see the acceleration of such applications. General Glosson added that he would be at the front of the line welcoming such a capability, because, he restated, you have to be committed to saving lives above all else. However, he does not believe that he will see in his lifetime the types of systems that will allow wars to be fought on a monitoring screen and then a victor declared. We will walk down that road, but we should not walk away prematurely from those things that have held us in good stead. Moreover, he believes that nation-states must be dealt with in a personal way, and that such a change cannot take place overnight.

Someone else in the audience took note of an interesting interplay between General Glosson's two lessons: the need for an up-front decision by the political leaders, and America's decreasing tolerance for casualties. He wondered why we did not learn the first lesson from our experience in Korea, and he asked whether we would have learned the second lesson had we lost only 5,000 people and 200 airplanes in Vietnam. By 2010, which of those two lessons will dominate the political conscience, and how do you reinforce them over a fifteen year period? General Glosson responded that it will be very important for those that talk about Air Force issues while educating outside groups to mention the two factors that he stressed in his speech. Failure to pay attention to one sabotages the other. A failure to make a proper political decision up front can lead to a tremendous loss of life. A poor doctrine base to execute a correct political decision can lead to the same tragic result.

#### **Fourth Session**

**Lieutenant General William E. Odom, Director of National Security Studies,  
Hudson Institute**

Lieutenant General William E. Odom (USA, Ret.) began the fourth session with a speech on aerospace requirements for U.S. security. He spoke first on the larger political and geostrategic issues. The nature of warfare has changed dramatically over the last two decades. The United States is unchallenged in the areas of advanced military technologies, theater warfare, transportation of military supplies, technical competence of personnel, C<sup>3</sup>, and intelligence and surveillance. Space capabilities have been critical to the U.S. edge. The United States clearly stands at the top of the "pecking order" after the cold war, "and the next 15-20 places were not even occupied." Japan and Western Europe cannot rival us, and Russia will not be competitive for a long time. The current defense build-down, however, likely will undercut our dominant military power.

The United States should not be engaged in all of the wars that will arise, but, he warned, it would be unwise to ignore some of them. For the most part, military engagements outside the Caribbean littoral will require a military coalition and only rarely unilateral intervention by the United States. Unique U.S. aerospace and C<sup>3</sup> capabilities will place this country in a position of coalition leadership, and our standard procedures developed in NATO will enhance our coalition management skills. The world needs a steady leader. Thus, NATO will play a special role in future crises, for it will make timely interventions possible.

Also, the U.S. military industrial base is no longer autarkic. We depend on many foreign sources for supply in peacetime and wartime. The economic health and security of the rest of the industrialized world will have profound implications in the United States. Hence, NATO will continue to remain important for this country.

General Odom spoke next about some of the institutional and methodological perspectives on determining U.S. military requirements. Experience shows that common sense and practical approaches generally have done better than the more scientific approach to sizing our forces. In determining our space forces, we will have to look at threats, uncertainties, and risks. In any case, one has to begin by looking at missions before a judgment can be made about requirements.

He said the term "aerospace" troubled him, that it smacked of being a term in search of a single mission. Space is a place, not a mission. A wide range of missions may be performed in this medium, just as many are performed in the air. There will be many missions in space, and there will be problems in sorting them out and assigning to them executive responsibility. This is a complex problem owing to the involvement of all the services, the private sector, and many other federal agencies. General Odom set forth some (but not all) of the space missions and departmental responsibilities.

- Communications. This mission is partially performed by space means. In determining future requirements, we will have to look beyond space systems.

All services and virtually every government agency uses satellite communications. The private sector supports government users. DCA, now the Defense Information Agency, manages the National Communications System.

- Weather Forecasting. This is performed by ground, air, and space systems. Commerce Department has a major responsibility here.
- Intelligence. This has a heavy space component, but ground and air components as well. The National Reconnaissance Office is more and more ill-equipped and ill-placed to accomplish the coordination task. Some intelligence functions need to be split up if greater integration is to be achieved.
- Ballistic Missile Defense. BMD necessarily has a space component, but it also will have a large ground component. Strategic and theater defense missions ought to be integrated with air defense missions. The question is, should force sizing be managed entirely by Space Command, or should such a determination be divided between the theater CINCs and the CINC Space?
- Scientific Research. This mission requires space platforms different from those used in defense. NASA has the lead in this mission, but the military uses of space are linked in many ways to the scientific research programs.
- Navigation. This mission has an important space component that has a variety of users, including such organizations as the American Trucking Association.
- Spacelift. This support mission affects all other space missions. It is a confused mission, not least because it is unclear which department or agency ought to have it, NASA? DoD? Air Force? the private sector? Until the spacelift mission is sorted out, it will be difficult to determine the military missions and align responsibilities of "sizing" space requirements.

There also is the issue of program execution, which General Odom believes could be performed by the Vice President's Space Council. If this were to happen, he believes we would discover that our space requirements are much larger than we realize. It also would be possible to develop a clearer rationale for all space programs, making it easier to justify them before Congress. Unless some radical changes are made to minimize turf wars and flawed understanding of space capabilities, we are likely to regress in this area.

He believes that Space Command is not needed, but that we do need a strategic defense command to handle the space part of missile flights. A sensible CINC does not want space support, rather he desires intelligence support, communications support, weather service, navigation aid, and ballistic missile defense. Can Space Command provide all of these services? Even if Space Command were given all space related responsibilities now assumed by other agencies, it would lack a capability to achieve synergism

between ground- and space-based capabilities, or even to make efficient resource trade-offs between space and ground capabilities.

The most important single change that could be made is to create an industrially funded spacelift agency to serve military, scientific, and private sector purposes. This would ease many turf quarrels and help with other useful restructuring. Today, we are not well organized to determine properly our needs on a mission-by-mission basis. Any estimates of what we will need in space will only be rough estimates. Quantity and quality issues will have to be worked together. In the meantime, we need a dynamic R&D effort as well as continued production of the quality and kind of existing aerospace capabilities that will allow us to continue to learn how best to use them in support of military operations.

#### **Dr. Alan Gropman, Industrial College of the Armed Forces Faculty**

Dr. Alan Gropman delivered the final paper at the conference, addressing the issue of how much aerospace force is enough for the new world order. The answer really depends on five separate considerations: 1) national security strategy; 2) the budget; 3) roles and missions; 4) size and capabilities of other U.S. air forces; and 5) the joint command and control doctrine governing command and control of joint air assets. On this last point, by way of clarification, the question we should be asking is whether the Joint Forces Air Component Commander (JFACC) is truly a commander or a coordinator (i.e., accepting of what Army, Navy, and Marines delegate to him)? If he is a coordinator, then the Air Force force structure probably will have to be larger than if he were a commander (i.e., capable of ordering air assets of the joint forces).

Dr. Gropman stated that, in analyzing these five considerations, he was guided by four principles. First is the requirement to plan for uncertainty. There is a pattern throughout history in most every government of not being able to foresee the coming of war, even if that war is just one month away. Second, we must plan to give the president options. The president needs a capability to project power where and when it is deemed necessary in order to secure national interests. Third, we must plan to integrate our efforts with the other services. No service has ever won a war by itself in the modern era. And fourth, we must plan to give this country a robust power projection capability. We need a plan to improve our mobility. The world we live in is dangerous, the character of our interests are global and multifaceted, and our role in the world is that of a leader of democratic, free-market-oriented states.

The present national security strategy, he believes, is weak and provides inadequate guidance. Nonetheless, we must look at this document for guidance and our orientation in the world. We may have to rely on the version of the *Defense Planning Guidance* provided by Secretary of Defense Les Aspin or the *JCS National Military Strategy of the United States*. According to the platform of President Clinton, the United States will continue to be involved in the world in much the same fashion as we have been, but there may be more emphasis on political and economic trends in the former Soviet Union as well as on the maintenance of the U.S. qualitative edge in advanced

weapon systems. Whether it is explicit or implicit, we must realize that the national security strategy is at the apex of all we do, and that all force structure decisions must conform to it.

Force structure also must follow the budget. Budget wars have caused a great deal of turmoil in the past. At the extreme, budget choices might force the services to cut muscle and bone rather than just fat. Under current proposals, the Air Force is unlikely to have to make such severe cuts. In any case, the Air Force should have a budget plan of its own that lists the likely threats and potential military strategies so that it can argue for a particular force structure (given what exists in the other services) when the time comes.

Roles and missions also will determine force structure. There is much discussion about functions now. Dr. Gropman believes that the Air Force should have the functions currently listed in the Unified Actions Armed Forces and relevant DoD documents because the Air Force has the broadest view of air power and it takes aviation seriously. The Air Force can get greater flexibility out of its air assets than can the Army, for example. The Air Force will do close air support better and can do it "in a strategic manner." Service doctrines also shape and size force structure. For example, the force structure would be built differently for an air force that saw the best approach to air superiority as primarily a defensive counter air effort versus an offensive counter air effort. Given the existence of joint command and control doctrine, the size, shape, and qualities of the other service aviation assets also will help determine Air Force force structure. There will always be some redundancy, however, owing to the flexibility of air power.

Finally, if the JFACC were truly a commander, the Air Force could be smaller. This is so because he could task the other air forces in the interests of the theater commander's strategy. If the services reserve the right to withhold forces, as they did during Desert Storm (which did not cause a problem because the Air Force had more than enough air assets), the Air Force will have to have more forces if they are to assure the completion of established missions. Owing to the fact that forces will be reduced, this problem ought to be resolved in favor of the JFACC being a commander.

The United States requires mobility to project power, meaning tankers, fighters, bombers, and airlifters. Stealth technologies and auxiliary aircraft for protection will help prevent substantial air losses, which is important when the force structure is projected to be smaller. Precision and stand-off weapons, sensor-fused weapons, and airborne command and control and airborne surveillance will become increasingly important. Given the current world security environment, we probably can live with our base force or a large fraction thereof if our other air forces are sufficiently robust.

#### *Fourth Session Discussions*

The first question from the audience to the panel asked how it could be determined when we have achieved a balanced force structure. On the one hand, posited the questioner, a balanced and joint force structure is that which provides the greatest

effectiveness and security for the nation. At the other extreme, balance and jointness mean a method for avoiding interservice squabbling. Dr. Gropman suggested that the availability of a strong Chairman of the JCS and a strong Secretary of Defense may help us to avoid interservice politics. Since we do not know where we will be fighting in the next twenty years, we cannot know what our force structure must be. He suggested that we could get by with a pretty small Army if we could know with certainty that we would never again fight in the jungles or in mountainous terrain, that is, in those regions where air power is limited. Since we cannot not know where we are going to fight, we do need a robust Army. If, for example, we became involved in Yugoslavia, we would need such a force. There are many places that the U.S. Air Force cannot get to very well. We also are likely to need a sizeable number of aircraft carriers to complement our forces.

General Odom stated his belief that aircraft carriers, a mid-twentieth century technology, no longer make sense in a age when land-based aircraft can make long-range flights. He did not see how anyone could come up with much of a justification for having very many carrier battle groups. The Navy, which has about 90% of its fleet in carrier battle groups, really has to do some thinking about its force structure. This is especially the case when you consider that there really is no other blue water naval force out there to compete with what we have. We need to figure out what makes sense for a twenty-first century fleet. He said his preference would be to have land-base aircraft covering large ocean areas rather than carrier aircraft.

Another in the audience raised the issue of credibility. He asked the panel to comment on the idea that for a nation's national security policy, its military strategy, and its supporting force structure to be credible, they have to reflect the strengths and weaknesses of the society rather than shape the society. General Odom noted that society is changing, but he did not think that the issue, as it was posed, was very important. General Odom thinks that the real issue is whether or not we are going to be engaged in the world. We are far more interdependent with other countries than most people realize. When this fact is realized, there will develop a fairly big consensus in this country for a reasonable commitment to a security system arrangement in Europe and East Asia. The question is, what will it take to maintain our commitments to these regions? We can expect to remain engaged in the Middle East for two reasons: oil and Israel. Iraq, Somalia, Yugoslavia, and Korea will also continue to draw the attention of the United States.

Dr. Gray returned the discussion to society's values, and the question was raised from the floor whether American sensitivities toward casualties have changed. Sensitivity to enemy casualties may have caused us to end the war against Iraq too early. Also, what if we had had two or three of our barracks destroyed by Scuds instead of one? General Odom thought that this last point was overdone, and that it overlooked the fact that the American public have accepted large casualties in the past, especially in Vietnam. Dr. Gray then mentioned to the questioner that General Glosson specifically addressed this issue of casualties. The questioner responded that his concern was more with the degree of emphasis; the issue, he thought, warranted more emphasis. Dr. Gropman

responded that at the apex of this question is the national strategy, and that national interests, objectives, and values all go into the formulation of that strategy.

Colonel Warden, speaking from the floor, noted that balance does not mean equality. He reminded us that the Romans put only about ten percent of their defense budget into the Navy while the British did exactly the opposite. Although these were examples of an imbalanced budget, this was exactly the way those countries, with their own security requirements, should have structured their forces. He stated that he believed that the United States ought to be investing more heavily in air power, because air power historically has tied in nicely with the national security requirements. Fifty or sixty percent of the defense budget devoted to air power would not be unreasonable.

Dr. Gropman responded that it may be that all we need are two carrier battle groups afloat at one time. He did point out, though, that the Romans did have to build a navy to go fight the Carthaginians. The British strategy made sense for what they were doing. Their forces were imbalanced, and it kept them out of problems on the continent. The bottom line is that we have to balance for our national interests.

#### **Summation and Closing Remarks: Dr. Colin S. Gray**

##### **Observations, Assertions, Arguments: Suggestions for Further Reflection**

This conference was not a study and hence could not reach conclusions. The course of the proceedings, however, registered many observations, assertions and arguments that merit further reflection. Some of those points and topics are itemized and discussed briefly below, for reason of their inherent importance. The conference organizers do not necessarily endorse the validity of any particular argument in this list, but they do find the issues raised, directly or by implication, to be significant ones.

1. Desert Storm--Window on the Future or Rear-view Mirror? Was the air campaign in Desert Storm the end of an era or a harbinger of a new period?--or some mix of the two? Did Desert Storm demonstrate what the U.S. assuredly can and will do to recalcitrant foes in the future?--or, will Desert Storm stand as a monument to what the U.S. would like to be able, and to be allowed (politically/strategically), to do? Is the principal lesson of Desert Storm to would-be foes of the U.S. "don't mess with the best," or is it "fight much smarter than did Iraq?"

2. Flexibility. This is the quality key to the unique military and strategic effectiveness of aerospace power and it requires imaginative, indeed "flexible," treatment if aerospace power is to reach its potential. This seemingly obvious claim merits a fresh look for the 1990's.

3. Stability in Defense Programs. Military history shows that constant change in defense policy and programs can be even more damaging than highly debateable, but enduring, decisions. For example, a poor decision (that stays decided) may result in the

acquisition of an aircraft that is not as proficient as it could have been: decisions that do not stay decided typically results in no aircraft acquisition at all.

4. The Fragility of Military Excellence. A first-class military establishment takes many years to build (considering the lead-time for skilled professional people, key equipment, suitable ideas and organization). Such an establishment can be brought low by ill-judged budget/force structure cuts in a very short space of time: that, at least, is what history repeatedly has shown.

5. Politics, Judgment, and Lead-Time. It is certainly plausible to argue that the U.S. would notice the emergence of a new major (superpower quality and quantity) security menace, and hence would have ample time to respond. The issue, however, is not whether there are storm warnings, but rather whether the leaders of a democracy would be willing, or able, to order some significant measure of defense mobilization long enough before a danger became "clear and apparent."

6. Prototyping and the Shelf-Life of Technology. It is a plausible fallacy to believe the claim that new defense technologies can be developed, even through prototype production, and then put on the shelf against future need. If a weapon, or other important support, system does not move into production within 2-3 years of its being "shelved," the opportunity to produce it typically will have been lost. There will be exceptions to this rule, but overall it is a sound assumption that new technologies have a 2-3 year "(begin to) acquire by" date.

7. Foreign Policy, Strategy, and Weapon Acquisition. At present there is an indeterminacy about the central pillars of U.S. foreign policy that translates into a lack of robust guidance for strategy, and hence for force planning. The challenge is not (necessarily) to endeavor to replace "containment;" it would be unsound to replace one overarching concept with another simply as a matter of policy and planning convenience. Nonetheless, more work is needed on the problems of how to plan defense for an era that lacks a dominant threat. The consequences of failure to design a convincing methodology could be dire indeed for national and international security.

8. "Surge and Coast"--the Defense "Wave Train". It is "the American way" in defense preparation to surge defense budgets and procurement orders in response to periodic security alarms, and then to coast, or surf, "down" the wave until the next alarm occurs. This "wave-train" motion in defense allocation is easily represented statistically and graphically. The lessons for acquisition are arguable but important. If truly orderly and stable defense programming is impractical, given the politics of a popular democracy, at least one can attempt to work with, rather than against, the apparent facts of the "wave-train," "surge and coast" phenomenon. Several candidate "lessons" invite attention: (a) be ready with technologies ready for acquisition when(ever) the next alarm/budget "surge" appears (but note the significant caveat in point No. 6 above); (b) alarm surges last only for 3-4 years, any new weapon that requires 3-5 years of further R, D, T, and E before it is a live candidate for system acquisition, will be overtaken by the politics of diminished alarm and much reduced budgets; (c) a lengthy process of defense mobilization/reconstitution itself may need protection (a surge in procurement orders

can encourage an enemy to fight sooner rather than later, e.g., Japan in 1941—U.S. forces were well equipped in late 1943–45, not in 1941–early 43).

9. "Efficiency" in Force Planning. Compared with the multidimensional costs of war, defense preparation is almost invariably a wonderful bargain. That common-sense fact can be difficult to establish, however. The dollar, social, and allegedly economic opportunity costs of defense frequently are compared not with the costs of active hostilities, but rather with the absence of the costs of defense. It is an uncomfortable, but inescapable, reality that force planning is an art and not a science, no matter how mathematical the analyses that support decisions. It is impossible to determine historically how much was, or should have been, enough, to deter or win wars in the past. How much more difficult is it to determine how much is enough for the future? Audiences culturally prepared to demand precision, exactitude, and "efficiency," need to be reminded of the "basics" of the problem. Specifically, the U.S. Government today has to decide how much and what kinds of force structure will be needed in order to deter or defeat: an unknown enemy; over an unknown issue; at a time unknown. "Scientifically," just how does one decide how many wings and wing-equivalents the U.S. Air Force will need in 2003 or 2013? Need to do what?—and against whom?—and to what strategic ends for which policy purposes? Fortunately, there are ways to conduct force planning that take proper account of uncertainty and do not attempt the impossible in foolishly detailed prediction. Nonetheless, the defense planner is all but trapped into arguing for the "wrong" range of future forces. On the one hand, he/she will identify forces too large and potent for conditions of a genuine political peace. On the other hand, he/she will be constrained by political-fiscal realities to identify forces much smaller than conditions of acute crisis or major war would require. Unlike an insurance policy, the existence or size of which should have no consequences for driver safety, defense-program insurance actually can influence the risks that will be run. It is a politically unfortunate fact that a truly healthy U.S. defense program encourages a course of international events that will appear to invalidate it.

10. Experts Can Err. The scope for, and prevalence, of ultimately demonstrable error, effectively is unlimited. To notice that experts often err is not to suggest a value to lack of expertise. It is probably important, however, to notice that "experts" tend to acquire that status by knowing more and more about less and less. Given that the question of the utility of aerospace forces for deterrence and war is a "whole war/peace" problem area, plainly there is a danger that even when experts gather (collective noun, a confusion of experts?), the totality of their wisdom may be rather less than the sum of their all too distinctive parts. The Air Force should be aware that: (a) there are things that experts cannot know (the future in detail); (b) there are things that experts tend to misassess (the consequences of trends visible today); but that (c) there are rational and orderly ways to reduce the risks of acting on advice that may be less expert than it seems. By far the best protection against lending an undeserved authority to contemporary standard wisdom that is fallible, is to invest modestly in an appreciation of what history can teach. Generically, there is little, if anything, by way of a defense-planning challenge in these 1990's that the defense planners of previous periods have not had to face.

11. Post-War, Inter-War, or Pre-War, Period? Historians and political scientists long have noticed that the political "mood" of the American people is among, if not actually, the most fundamental of influences upon the scale and character of the country's defense effort. It matters greatly whether the public believes that the ending of the Cold War and the demise of the evil empire of the Soviet Union has given birth to a long, indeed permanent, peace (vis à vis major war, that is, not all local and regional conflict), or whether they regard these years as but an inter-war era. From 1919 until 1932, the British maintained what was called the "Ten Year Rule," which was guidance to the military establishment directing the reasonable assumption of an absence of British participation in a major war for ten years. What comparable assumption should guide U.S. defense planning in the early 1990's? Is there a superpower quality and quantity of enemy in the U.S. future for five, ten, fifteen, or twenty years? What is the prudent, yet domestically supportable, assumption? Is it possible to conduct long-range planning for the USAF, and to develop a politically viable system acquisition strategy, that is effectively assumption-independent regarding this point?

12. Paradigm Change. Whether or not the dominant threads in U.S. domestic politics are reading the course of international history correctly, it is a fact that paradigm change is being imposed by still emerging fiscal (which is to say political) realities. The challenges are twofold. First, the Air Force needs to impose such rationality and prudence as it is able upon a process of paradigm change that is moving regardless. Second, there is need to proceed, game-theory wise, on the guidance of the "minimax" principle, and limit potential damage through adoption of the best available of a short range of more or less undesirable options. While it is essential that the USAF both look and truly be an air force of the 1990's, the air force the U.S. may need in the future has to relate to possibly far different contexts. A new paradigm fashionable, politically correct even, in 1993, may be about as valid as one selected in 1922-23 (for the late 1930's), or 1945-46 (for 1949-90). Immediate post-war judgments have to be treated with caution.

13. Technology and the Peril of the "Last Move". Technological advance is a routinized fact of life today. There is an industry, or perhaps sub-industry, whose entire business is the generation of technical change. Along with technical change goes, or can go, organizational, doctrinal, tactical, operational, strategic, and even political, change. Everyone knows that there is no "last move" in technology, doctrine, tactics, operations, strategy, or policy, but in practice that critical fact often is forgotten or discounted unduly. History is littered not only with examples of military establishments who failed to learn from their past mistakes, but even more often with cases of military establishments wedded to the apparent causes of their past victories. The situational dependency of the instruments "causing" military success can be difficult to remember in the glow of the triumph of victory. The real Napoleon was a sound professional who also was a typically lucky opportunist. It was Napoleon's interpreters—preeminently the Baron Antoine Henri de Jomini—who reduced the Napoleonic way of war to a formula. No matter the identity of the "wonder weapon" of the day, there is always a successor weapon, tactic, operational ploy, strategy, or policy choice, tomorrow. Conflict's paradoxical logic implies that today's success can be the basis for tomorrow's

failure. A wise future enemy of the United States will not position and equip itself to wage a symmetrical form of war with the victor of Desert Storm.

14. Superior Strategy. Giulio Douhet was unusual in "being convinced with mathematical certainty that the facts would prove me right," but one can approach his level of confidence with reference to the importance of strategic reasoning. Recent Air Force reorganization most usefully has underlined the true relationship between strategy and tactics. Tactics is the realm of forces in action; strategy is about the consequences of the use of forces for the course and outcome of war. If purposive strategy does not command the means-ends nexus, then the tactical and operation levels of war can proceed to undesired, or even irrelevant, results. Strategy is a guiding theory that explains how selected means are employed to reach intended objectives which, in their turn, achieve policy goals. The story of Air Force utility for the country in the future is only instrumentally a story of tactical and operational prowess. Ultimately, that story has to be one of strategic effectiveness in expression, and implementation, of high policy.

15. Aerospace Power and the American Way in Defense and War. Contemporary aerospace power has high appeal in American strategic culture. Aerospace power is high technology, it provides reach and grasp over great distances, and with smart weapons it is the embodiment of marksmanship (the successor to the Kentucky long rifle is an F-15E Strike Eagle with laser-guided munitions). Aerospace power offers the ability for the United States to intervene with decisive, precisely focussed, force without having to be present in large numbers on the ground. Countries tend to perform most effectively in the strategic realm when their military action fits traditional national preferences and values. American strategic culture long has believed that war is an evil last resort of statecraft that should be waged only against the enemy's military system, not against his society. Air power always has held out the promise of the arm's length paralysis of a foe's ability to defend himself, but not until 1991 has theory and practice actually met. In addition, American culture is sensitive both to American and even to enemy casualties. Air power provides relatively few American hostages to the fortunes of war. A caveat is necessary: the precise strike from the sky, although attractively economical in many senses, can cease to meet public expectations of right conduct in war if it begins to approximate a "turkey shoot," even against people in uniform. The problems for Coalition war-making posed by the "road of death" out of Kuwait epitomizes this dilemma.

16. "Think Space". It took many decades and much painful experience to accomplish, but both the Army and the Navy have come to "think air" with respect to the full range of potential operations. In short, air power in its several forms, including the enemy's, is a permanent and critical part of the mental universe of ground and maritime planners and doers. Thus far, space, the fourth dimension of war, has yet to enjoy a measure of appreciation of its growing importance even approaching that of air. The belief and the words are there at the highest levels of the military establishment, but the reality is that space assets, actual and possible, have a way to go to achieve the desirable level of integration with air, land, and sea operations. Desert Storm provided important

evidence on what space power could mean for air power, sea power, and land power, but that experience is but a milestone on a long road. Delay in appreciation of the importance of space could put U.S. (and Allied) terrestrial forces in great peril. First, U.S. forces may lack the benefits of an essential "space layer" to multi-layered theater missile defenses. Second, an absence of space-control assets to fight in space for the right to use orbit could well mean that in a regional conflict U.S. forces would confront a foe whose military power was supported, i.e., multiplied, by navigation and targeting, communications, intelligence gathering, and meteorological assistance from spacecraft. In the conflict in the Gulf the Iraqis did not contest the U.S. use of space. In a future war the U.S. may not be so fortunate.

17. Lessons of History. Defense communities, including armed services, almost invariably either forget some significant items of what historical experience has taught (e.g., the importance of close air support, a lesson forgotten three times already), or recall and seek to replay slavishly that which worked "last time." There is no way to inoculate an organization comprehensively against all variants of a dysfunctionally selective memory. Nonetheless, a conscious effort can be made both to scan for emerging trends that appear, singly, in combination, and in probable consequences, to be genuinely new, and to learn from a wide variety of historical experience. Thus, Desert Storm would be viewed in the full stream of the historical record of aerospace power in war, rather than as a break-point. An armed service certainly should change in the light of recent combat experience (inter alia), but it should not change solely so as to fit the mold of that experience. If it were to do the latter, quite literally it would be preparing to refight the last war. Overall, it is important to avoid being captured by (unrepeatable) recent history, especially if such capture is viewed as a supposed liberation from history. History, properly approached, does have lessons to teach. Unfortunately, hard work is required if those lessons are to be discovered. History does not provide answers, but it does suggest strongly the questions worth asking. On the macroscopic scale, the early 1990's are not the first span of years wherein the United States has downsized her armed forces drastically. The U.S. experience in the 1920's, 1930's, and mid-to-late 1940's, provides nourishing food for thought.

These points and arguments, to repeat, cannot stand as "conclusions." Such authority as they have derives strictly from the fact that they were raised or implied by conferees, and that they each point to topics that merit further reflection.

## **Aerospace Power Conference**

### **Presentation Overview**

**J.A. Warden**

**16 March 1993**

#### **Synopsized conclusions.**

**-The Gulf War was the first war of the first true military technical revolution. It represented a shift in warfare as dramatic as the shift from a Newtonian world to a quantum world--and in fact the basis of the revolution is largely in the quantum world. This idea can be difficult to grasp because the simultaneous execution of old style mass warfare masked the truth just as a collection of glowing vacuum tubes might overshadow a single, cool microchip in their midst. The Gulf War ushered in the era of the very small, very important target vulnerable to the single weapon.**

**-Strategic and operational level lessons from the Gulf War are generally valid. We should be very comfortable in accepting the Gulf War as a valid data point and to moving forward from it.**

**-A logic force structure to flow from the Gulf War is one which is built to capitalize on precision. In an era of reduced budgets, it must emphasize those tools of war with the greatest productivity and the greatest potential to become even more productive. It must also be in consonance with a general Western move away from destructiveness and bloodshed in war. It should keep the US a revolution ahead of every competitor in key technologies. And finally, it should be designed to thwart new attack concepts which will be tried by those who can no longer depend on mass derived from numbers.**

**The Gulf War as the first manifestation of the first Military Technical Revolution.**

**What was war before this revolution.**

**-War from time immemorial can be categorized as sequential attempts to break through or defend a line. Despite significant differences in technology, there is little conceptual difference between Alexander's plunge through the Persian line at Arbela and Guderian's plunge through the French lines at Ardennes two thousand years later. The need to gain combat power by massing significant numbers of men and equipment has**

made sequential war a necessity—as expressed by the “principle of war” which insists on concentration of numeric forces.

What is war after the revolution.

-New war is parallel war directed against the enemy system where a significant portion (conceptually even all) of the enemy's vital strategic and operational level possessions come under near simultaneous attack, where the concept of a line to defend or attack loses meaning, and where mass is redefined from Newtonian to quantum terms. It is war of a thousand instantaneous cuts—where each cut in itself may be easily manageable but taken together are fatal.

What makes this revolutionary style of war possible.

-Precision weapons which make possible precision effects on significant enemy strategic and operational level targets.

-The ability to produce precision effects in many different places in parallel.

-An understanding of enemy strategic and operational organization.

Major lessons of the Gulf War the most valuable and enduring lessons are those at the highest levels of strategic or operational abstraction: the precise tactics and weapons technology Hannibal used to produce the double envelopment are now irrelevant.

-Any organization is most vulnerable at the strategic level. Properly executed attack on the enemy's strategic base puts the enemy in an impossible position.

-Destroying the enemy's ability to receive and transmit information creates rapid strategic and operational deterioration. Imposing your own information on the enemy accelerates the pace of deterioration in the Gulf War.

-Loss of strategic air superiority puts a state at the mercy of its enemy.

-Military forces are extremely vulnerable at an operational level.

-Loss of operational air superiority (defined as loss of air superiority over fielded military forces) puts an army or navy or air force at the mercy of its enemy.

-Stealth and precision weapons give an entirely new meaning to the concept of mass, as a system are equally applicable to states, criminal organizations, and non-states. The tactical method of execution, however, may vary widely across this spectrum.

-If there is no organized enemy, the problem is more akin to the problem of quelling a riot than to war.

-Stealthy, precision delivery is as useful in a Yugoslavia situation as it was in the Gulf—except the thing being delivered is more likely to be food and medicine than destruction.

-Information dominance is at least as important in Yugoslavia type situations as it was in the Gulf.

#### Operationalizing Gulf War lessons.

-First, must accept that a revolution has taken place. Must not be like the French knights at Crecy, Poitiers, and Agincourt; or the Prussian observers at Austerlitz; or the battleship proponents who witnessed the Ostfriedland sinking, or Toranto in December 1940.

-Must be ready to shed ideas, tools, and missions which are no longer productive, safe, or economically feasible.

-Must beware of doctrinal rigidities and parochial attachments to modern day equivalents of sailing ships and horses. In today's fast moving world, failing to grasp the future dooms an organization to irrelevance at best and death at worst.

-Must fight centralization and bureaucratization of organizations and ideas. Success in the future will demand enormous physical and mental agility. Especially important to beware of reactionary ideas masquerading under the sirens of false jointness.

#### The new force structure.

-If its success depends on accumulating large numbers to ensure success, dispense with it.

-Focus on precision, on making it better and better. Use the microchip as the role model.

-Focus on forces and ideas which can execute rapidly, and with the minimum of lethality on both sides.

-Look for commonality among civilian and military requirements and technology concentration.

-The ability to react to parallel war is limited.

-At the ground war level, air power provided the shock previously provided by combinations of artillery and armor.

-Seizure of territory is not required to defeat an enemy's fielded military forces, nor is it required to defeat him at a strategic level. It may, however, be needed to fulfill political objectives like colonization or reorientation of the enemy society.

-Air occupation is a viable means to achieve many political objectives short of complete subjugation.

-Air will dominate for foreseeable future.

-A modern air campaign requires full and complete integration and participation from a very wide group of experts ranging from public affairs to nuclear engineers to electrical engineers to medical personnel to legal personnel to flyers to logisticians to intelligence officers to communicators...ad infinitum.

-Great generalship at the "joint" level is achieved through orchestration of campaigns conceived and executed at the component level.

#### Enemy lessons from the Gulf War.

-Deployment and employment of mass armies is fruitless unless you can maintain strategic and operational level air superiority—a daunting task if the US is opposed to you.

-The idea that Saddam could have won had he only pressed his attack in August is pure myth.

-Don't do anything which will give the United States a casus belli.

-If you make an enemy of the US, you must devise some method to attack US strategic centers of gravity.

#### Applicability of Gulf Lessons to other types of conflict.

-The general concepts and lessons of the war including the concept of inside-out war, attack on centers of gravity, emphasis on the strategic, and understanding the "enemy".

## Planning for the Next Quarter Century: What in the World is and Air Force to Do?

by Sam Gardiner<sup>1</sup>

*To prepare for war demands, then, exercise of the imagination. We shall glance at the war of the past long enough to retrace its essential features; we shall ask of the present what it is preparing for the future; and, finally we shall try to decide what modification will be made in the character of war by the causes at work today.*

Douhet

Okay, the world has changed. Okay, the world is changing. Change is the first paragraph in every paper. Change is the first point in every speech. That doesn't make it easier. The dilemma is the Air Force must still make decisions for the future. The dilemma is the Air Force of the future is being decided now. The dilemma is making decision in a changed and changing world. The dilemma becomes trying to reduce the magnitude of the dilemma.

Douhet made it sound simple enough. Glance at the past long enough to retrace the essential features of war. Ask what the present is preparing for the future. Finally, decide what modifications will be made in the character of war by the causes at work today. I use his guidance to penetrate the dilemma.

In this paper, I argue that our inability to define future conflict is not unusual. In past, American planners -- Air Force planners -- even when they thought they understood the future for which they were planning, were wrong. Future conflict turned out to be different than the future for which they had planned. I argue that just because the future is vague does not mean we cannot begin to understand the possible characteristics of a future conflict. Once we have some appreciation of those characteristics, we can begin to describe the demands that might be put upon the Air Force in the future. We can begin to understand the requirements. We can begin to answer the question, "What in the

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<sup>1</sup>Paper Presented on March 16, 1993, Conference on "Acrospace Power's Role in American National Security in the Next Quarter Century."

world is an Air Force to do?" We can begin to understand the Air Force we need for the early part of the next century.

#### PLANNING FOR THE NEXT WAR.

War is the norm. Over the past 3500 years of recorded history, the world has been without war about 10% of the time.<sup>2</sup> Obviously, we need to plan for war. All we need to know is which one and when. That's the difficult part. Which one? Which war?

Maybe we can begin by looking at the reasons for war. Good idea, but, we meet another difficult part. We have planned for the past 40 years based on the assumption that war would start because of the clash of ideologies. If there were going to be a war, we accepted it would come out of the struggle between democracy and communism, a most basic clash over the political and economic structure within which people would live. That logic, the logic that wars are a clash of ideologies, does not hold as much promise we look to the future.

If wars might start for reasons other than the conflict of ideologies, we are overwhelmed with theories. Wars might be started by ambitious dictators, Hitlers; that might offer an explanation of the Gulf War. Wars might stem from accidents; Barbara Tuchman used that to explain the origins of World War I.<sup>3</sup> Wars might be caused by economics either the competition for resources or even the actions of industrial giants, a popular theory after World War I. Wars might have their origin in domestic political pressure; some have suggest the invasion of the Falklands by Argentina was driven by this kind of pressure. Future wars might come from the disintegration of countries into nations; the fighting in Yugoslavia and the former Soviet Union might be the pattern of the future.

Maybe it's because we don't understand the causes. Maybe it's because war has so many causes it is difficult to predict. In either case, at the most fundamental level, we have difficulty envisioning the next war because we don't fully understand why wars start. There is more.

We constructed a comfortable logic pattern. We did not to have to think about the causes of war, but we could still get on with determining force requirements. Define national interests, identify the threat to those interests,

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<sup>2</sup>In 1968, they wrote, "In the last 3,421 years of recorded history only 268 have seen no war." Will and Ariel Durant, *The Lessons of History* (New York, NY: Simon and Schuster, 1968) p. 81.

<sup>3</sup>Barbara W. Tuchman, *The Guns of August* (New York, NY: Macmillan Publishing, 1962).

apply the strategy and determine force requirements. It was quite simple. Was it so simple?

When we have gone about the process of defining national interests, we did defining the national survival part. After we listed national survival, it wasn't so easy. We had thought the defense of Korea was not in our national interests; that changed. We never envisioned a threat to interests in Southeast Asia at the time the force structure was being developed that would eventually be used there. Early, we were not even clear with Iraq that our national interests would involve the defense of Kuwait. The post World War II report card is terrible when it comes to defining national interests.<sup>4</sup> There is more.

Although we always listed them in order – national interests, threats, strategy – they do not seem work in order. Strategy and interests cannot be separated. A driving reason Korea and Vietnam were in our "national interest" was the strategy. By defining a strategy of containment, we defined what would be in our interests. Strategy defines some interests. The strategy defined at least two our post-World War II conflicts. To understand the reasons we would go to war, it seems we need to understand the strategy.

Here comes another difficulty. The decisions we make now will affect the force structure for the next 20 years. We don't know what the strategy is going to be in 20 years. We only know today's strategy. We assume we will have the same strategy. That's not a good assumption. We have not fully defined what we want to be in the new world. There will be five more presidential elections, maybe five administrations. We will have a different national security strategy and a different national military strategy when the quality of our current decisions is tested.

What in the world is an Air Force to do?

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<sup>4</sup>This difficulty has been recognized by others. In 1953 when the Air University was in the doctrine writing business, a revision to the basic air doctrine manual was prepared. In the draft the writers began with national objectives and policies. The statement of national objectives and policies was eliminated from the draft because, "that was much too precise to be acceptable by the Air Staff in Washington." Robert Frank Futrell, *Ideas, Concepts Doctrine: Basic Thinking in the United States Air Force, 1907-1960, Volume I* (Maxwell Air Force Base, AL: Air University Press, 1989) p. 7.

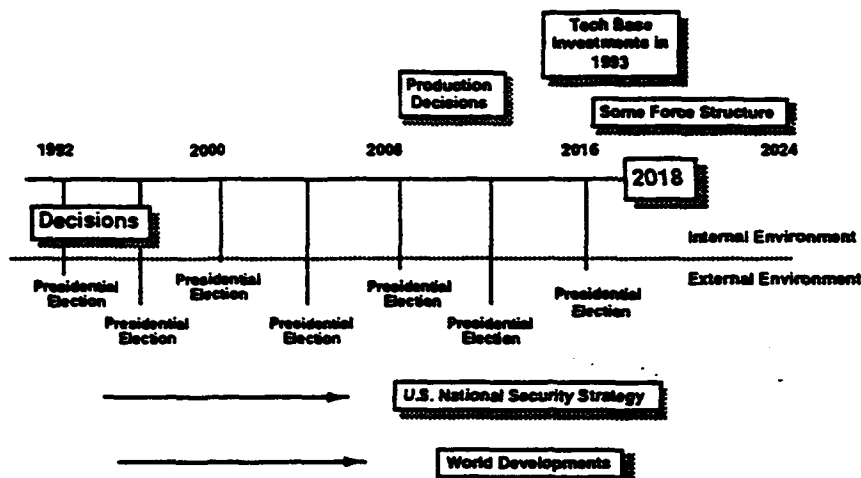


Figure 1. The Dilemma of Envisioning the National Security Environment 25 Years from Now

#### UNDERSTANDING THE CHARACTER OF THE NEXT WAR.

If it is so difficult to describe where the next war will be, maybe we can think about the character of the next war. What kind of war? If we were to prepare for the right war, it might not matter whom we are called upon to fight. That was the beauty of the Gulf War. We thought we were preparing to fight the Soviet Union. Those preparations fit wonderfully against Iraq's capabilities.

Preparing for the next war, we need to ask ourselves if the Gulf War means that when you are good you are good. Or, does it mean when you are lucky you are lucky?

There is a beginning point. The character of warfare does not change in a linear way. That is a major factor in creating our dilemma, an important part of understanding what we need to do to structure for the future. As Martin van Creveld, the Israeli historian, wrote:

*With each side seeking to achieve his objectives while preventing the other from doing the same, war consists in large part of an interplay of double-crosses. The underlying logic of war is, therefore, not linear but paradoxical. The same action will not always lead to the same result. The opposite, indeed, is closer to the truth. Given an*

*opponent who is capable of learning, a very real danger exists that an action will not succeed twice because it has succeeded once.*<sup>5</sup>

If we are to understand the dilemma, we need to understand the paradoxical changes we might face in the future. If we are to understand the dilemma, we need to understand how the linear changes in technology might lead to nonlinear changes in the character of war and warfare. If we are to understand the dilemma we need to think in terms of discontinuities.

As the world moved toward World War II, American planners began to see a developing threat. The planners did a major study in 1937. The conclusion was sharp, "serious threats to the Continental United States and its possessions." Those who worked on the study didn't mean a threat to interests as we might interpret that statement today. They meant a threat to our territory. They meant Germany establishing bases in Latin America, attacking the Panama Canal and taking the Dominican Republic. They meant the United States being bombed. In November 1938, when the President announced the goal of producing 10,000 aircraft a year he said, "We must have a large air force in being to protect any part of the North or South American continent, and we must have a sufficiently large air force to deter anyone from landing in either North or South America."<sup>6</sup> The planners, even that close to the start of World War II, did not understand its character.

In August 1948, Colonel William Momyer, the director of Plans for Tactical Air Command, did an analysis of the Air Force mission in the next war. He concluded that tactical air forces would not become involved in hostilities unless the atomic offensive failed and the war "degenerated" into a conventional battle. He did not envision the conventional phase would occur at all. At least, it would not occur until two years into the war. Two years was the right number. In two years the United States was fighting a conventional war in Korea.<sup>7</sup>

If the changes in warfare are not linear, we still need to try to understand them. We need to be able to put some bounds around possible futures.

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<sup>5</sup>Martin van Creveld, *Technology and War: From 2000 B.C. to the Present* (New York, NY: The Free Press, 1989) p. 316.

<sup>6</sup>Stetson Conn and Byron Fairchild, *United States Army in World War II, The Framework of Hemisphere Defense* (Washington, D.C.: Office of the Chief of Military History, Department of the Army, 1960) pp. 6-7.

<sup>7</sup>Robert Frank Futrell, *Ideas, Concepts Doctrine: Basic Thinking in the United States Air Force, 1907-1960, Volume I* (Maxwell Air Force Base, AL: Air University Press, 1989) p. 239.

What in the world is an Air Force to do?

## THE CHANGING CHARACTER WARFARE

What of the present is preparing for the future?

### Objectives of war

Clausewitz argued war should be an extension of policy. War is not an end; war is a means to an end. During the Cold War, although we were not always explicit about the assumption, we believed we were in a fight for survival. The conflict we were most planning to avoid would be one that involved whether or not the United States would survive as a nation state.

Even our strategy reflected our seeing the conflict as being unlimited. We would defend forward, but if forward defense failed, we would be willing to use nuclear weapons, first tactical nuclear weapons and if necessary, strategic nuclear weapons. Although the fundamental objective was deterrence, we accepted that this might lead to a nuclear exchange. In Clausewitz's terms, our policy objectives were unlimited.

More limited objective seems to be an emerging characteristic of the conflicts in which the United States might be involved. We had limited objectives in Lebanon. We had limited objectives in Grenada. We had limited objectives in Panama. The Gulf War was fought for limited objectives. The scenarios we see being discussed for structuring the force are all conflicts with limited objectives. The regional basis of the national military strategy is based upon an assumption that wars in the future will be fought for limited objectives.

The use of military force is an act of policy. In limited conflicts, the use of force is an act of limited policy. In conflicts with limited objectives, both the kinds of forces and the way in which they are employed are affected by the belligerent's objectives. Again, this seems to suggest some fundamental differences in the way we need to deal with the future. This seems to suggest we need to think about conflicts where opposition objectives are can be diverse. We need to think about conflicts where our responses will be diverse. The changing character of war affects the character of warfare.

## Force Sizes

An interesting worldwide trend is the reduction in the size of standing military forces. It's happening in the United States; it's happening in the republics of the former Soviet Union; all of the NATO countries are moving to smaller standing forces; Japan has announced a reduction in the size of its defense budget. Even Iraq has announced it will move in the direction of a smaller more professional force.

## Forward Deployment

Another change is taking place along with the reduction in sizes of militaries. The change is particularly important for the United States. The forward deployment of forces in Europe and Korea has meant our thinking about wars unfolding in certain ways. Not being forward deployed changes the ways in which war would unfold. Again, this change has some important consequences for the future.

## The Information Component

It would be difficult not to appreciate that information systems are having an impact on the character of war, whether it is in instant television reporting from the battlefield or in the ways in which information is exchanged and process in units. Information is changing war and warfare.<sup>8</sup>

When the Germans attacked the Allies in 1940, there was an interesting disparity in information about the condition of the French Army. In Berlin, the maps showed the French still to be strong. The German commanders leading the attack had a different view of the war, a more accurate view of the war.<sup>9</sup>

Whether it was in 1940 or even during the U.S. Civil War when commanders operated under a tactical axiom to "move to the sounds of the guns," the historic flow of battlefield information was from the bottom to the top once the fighting started. Lower echelons kept higher echelons informed.

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<sup>8</sup>At this point in the paper, I could have started with technologies. If I would have done that I would have begun with something like the seven technology thrusts from a paper done by OSD's Director of Defense Research and Engineering, "Defense Science and Technology Strategy," July 1992. Another option would have been to use the technologies identified by the National Research Council, *Star 21: Strategic Technologies for the Army of the Twenty-First Century* (Washington, D.C.: National Academy Press, 1992). The next step would be to talk about changes in weapons that come from the new technologies then go to the changes in warfare. To keep this paper within some reasonable length, I've chosen to go directly to the impact on warfare of the weapons changes that will come from the technology changes.

<sup>9</sup>See Erich von Manstein, *Lost Victories* (Novato, CA: Presidio Press, 1982) pp.127-147.

Satellites, electronic intelligence, airborne collection platforms, numerous systems are changing the historical flow of information. During the Gulf war, articles appeared in the press that reflected complaints of tactical commanders. Tactical commanders were not getting the up-to-date information available at higher headquarters. More and more information flows down to units, not up but down. The future seems to hold more of the same.

In its list of the ten critical technologies for the next century, the *New York Times* selected five directly related to information technologies. For the U.S. Army, in its list of emerging technologies for the early part of the 21st century, information systems will be an important part of future battlefields. The United States Navy identified information systems as being significant for the fleet of the turn of the century. Information is clearly an important dimension of future war and warfare. Information will significantly change warfare.

### **Lethality**

More ordnance can be delivered more accurately. Increased weapons lethality has been one of the most profound changes in the nature of warfare. The A-10, for example, can deliver in a single sortie almost twice the ordnance an F-100 could deliver. The Army's Multiple-Launch Rocket System delivers significantly more firepower than could be delivered by artillery.

Looking to future systems, there is no reason to believe that lethality won't continue to increase even as dramatically. Work is moving forward on enhanced blast warheads. All of the Services are developing delivery systems with "smart" submunitions.

Weapons lethality has increased and should continue to increase. To say it again, weapons lethality has increased. I'll come to my reason for the emphasis.

### **Range**

Along with increases in lethality, ranges have been increasing. Aircraft have greater ranges. Artillery has greater ranges. Missiles are adding delivery range. Future systems will involve even more additions to range. At the extreme, the B-2 will be able to deliver conventional weapons on targets anywhere in the world from U.S. bases.

## **Proliferation**

Iraq's efforts to develop a nuclear weapon appear to be part of an emerging trend. India, Pakistan, Israel, North Korea, maybe even Iran -- the path to becoming a relatively important military power more and more seems to involve acquiring weapons of mass destruction.

## **CONSEQUENCES OF THE CHANGES: THE TRENDS**

One way to view the changes taking place is in the context of trends that were evident before the changes took place. Where do the changes fit?

### **Campaigns**

For almost ten years, the JCS dictionary of terms did not contain the word "campaign." The combination of limited objectives in war and not being forward deployed means that the most likely sequence of events will not be a short and swift conventional combat period followed by escalation. The most likely sequence of events will be a series of maneuvers and battles that would be put together in a way to achieve a military objective. The most likely sequence of events is a military campaign. The most likely sequence of events will be closer to DESERT SHIELD/DESERT STORM than the 15 to 20 days of combat we had envisioned previously in Europe. No matter how desirable, a quick and decisive solution may not be possible.

### **Interchangability**

In the Gulf War, Army attack helicopters were used to against Iraqi air defense radars during the initial air operation. One of the consequences of increased ranges of systems has been that different systems become more interchangeable. Army, Navy and Air Force systems become more interchangeable.

During a recent hearing before the Congress, the Navy was asked why it needs a replacement for its carrier-based attack aircraft when the B-2 could strike the same targets. If the Army were to acquire a missile that is currently in the concept stage with a range of 500 kilometers, the interchangability would even be more important. New range of Army systems will blur the distinction between the close battle and the deep battle. New ranges of Navy systems will mean any

future battlefield can be reached by littoral operations. Range used to define service missions, that has become and will become less and less so.

### **Fragility of Units**

During the Civil War, it was not unknown for units to suffer 40, 50, and even 60 per cent casualties and continue to fight. The Wisconsin Iron Brigade at Gettysburg is an example. Despite those kinds of losses, the unit not only continued to fight but maneuvered to alternate positions.<sup>10</sup>

The classic combat decision cycle is (1) sense, (2) process (3) decide and (4) act. For the Iron Brigade, this cycle was taking place in a very restricted environment. The trend in the flow of information where intelligence and even targeting data may be external to a unit changes the nature of units. Units have become and will become more fragile. It is possible to conceive of units that could be combat ineffective with no losses to personnel or equipment but with only a loss of its connection to an external source of information. Breaking the combat decision cycle could be more important than the destruction of combat equipment.

### **Tempo**

If information can be processed faster and ranges are greater, the immediate consequence is that the tempo of operation in war is faster. Again, this is a trend that can be seen historically and projected into the future.

In OVERLORD, the Allied invasion of Europe in 1944, a major deception plan was crafted to hold the German panzer divisions from counterattacking the landing force. To be successful, the counterattack had to be delayed for a week to ten days while the beachhead was established.

In the British operations to retake the Falklands, the objective of their deception plan was to give the landing four to six hours to establish itself ashore before the Argentine Navy air attacked. The deception plans had similar objectives but the timing was significantly more compressed in the 1982 war.

### **Density**

If one of the major changes in warfare has been increased lethality, the battlefield must be a more lethal place. Interestingly, despite more lethal

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<sup>10</sup>Edwin B. Coddington, *The Gettysburg Campaign: A Study in Command* (New York, NY: Scribner's Sons, 1968) pp. 286-322.

weapons systems, battlefields have not become more lethal over time. The best work on issue has been done by Trevor Dupuy. He points out that casualties per day of combat have gone down over time; the response to lethality has been to reduce density<sup>11</sup>. Density has been going down faster than lethality has been increasing.

During the Civil War density could be as high as 2.5 to 5 men per meter. In 1914 a division would cover approximately 10 kilometers of the front; in 1986 that had increased to 30 kilometers<sup>12</sup>.

The trend in battlefield density highlights the paradoxical quality of warfare. Most would agree with the point I made earlier in the paper that lethality has increased. But has it? It has been increasing for the shooter and not the shot-at. In other words, to say that one of the unique characteristics of the Air Force is lethality is to miss what has been changing in the character of warfare.

## DISCONTINUITIES

To look at the impact of the changes in war and warfare in terms of only the trends is miss the impact of the changes. The impact becomes clear when the trends are understood together and to the point when they become discontinuities, when the future becomes qualitatively different from the past. We begin to see the accepted trends might change dramatically.

## Importance of Doctrine

Doctrine has always been important.<sup>13</sup> The British, for example, were first to think about tank warfare. Their original work was done by naval officers who saw the tank as a land ship. It was not until the Germans developed a doctrine to integrate infantry and armor into a combined arms team that the tank had its most important impact on the battlefield.

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<sup>11</sup>Trevor N. Dupuy, *Numbers, Predictions and War: The Use of History to Evaluate and Predict the Outcome of Armed Conflict* (Fairfax, VA: Hero Books, 1985) pp. 6-11.

<sup>12</sup>Chris Bellamy, *The Future of Land Warfare* (New York: St. Martin's Press, 1987) p. 276.

<sup>13</sup>I've used the term "doctrine" in this portion of the paper to refer to generally accepted employment concepts. Other nations and the other Services use the term in this way. Even the Navy adopted this definition in its new strategy paper, "Power from the Sea: The Maritime Component of the National Military Strategy," Department of the Navy, September 1992. When I arrive at a discussion of the meaning of the changes for the Air Force, I use the Air Force term "concepts."

The French were the first to acquire machine guns in significant numbers. They used their Montigny Mitrailleur as an indirect fire support weapon, as if it were artillery. It was not until machine guns were used directly in the infantry battle that they began to change the character of warfare.

Technologists say a scientific development becomes a technology in society when it has widespread understanding and application. The same is true in warfare. The most significant changes in warfare come when scientific developments and doctrine come together, when there is an understanding of how to use new weapons most effectively.

### **Possibility of Discontinuities**

Before addressing the discontinuities of future war and warfare, it is probably necessary to emphasize the point that two or three trends can produce an important discontinuity.

For example, if future systems include the capability to acquire targets with satellites or airborne platforms; if ranges of artillery system approach 100 kilometers; if smart submunitions allow artillery to be extremely accurate, then it would be possible to engage and attack an armor formation with artillery at great range. It would be possible for the deep battle to be more important than the close battle. It would be possible for artillery to become direct fire weapons. It would be possible for artillery to replace armor.

In other words, putting together the trends of range and lethality should force us to think in terms that are very unconventional. It should force us to think in ways we have not thought in the past. It should force us into new paradigms. It should force us to understand that we are no longer on a continuum.

### **Evolution of Doctrine**

To appreciate the discontinuities, it's necessary to understand how doctrine has evolved over the past ten to fifteen years. What stands out, again, is that we have reached a point where the future can no longer be thought of as a straight line of the past.

After the 1973 Arab-Israeli War, the United States Army produced a new version of its doctrine manual. The manual reflected some of the changes in warfare that stood out during the war. One of the statements in this manual was to the effect that if you can be seen on the battlefield, you can be hit; if you can be

hit, you can be killed. It was an interesting summary of how warfare was changing.

In 1979, Supreme Headquarters Allied Powers Europe proposed an initiative called Follow-On Forces Attack. The foundation of this doctrinal change was that NATO forces would do better in the conventional battle if tactical air could be concentrated on the second echelon Warsaw Pact forces.

In 1982, the U.S. Army published a new version of its *Field Manual 100-5, Operations*. The new manual introduced the doctrine of Airland Battle. The essence of the change was that in the Army's view, it could be accomplish its conventional mission by combining tactical maneuver and properly placed air attacks. Although Airland Battle was not intended to describe how NATO would fight, in combination with the Follow-On Forces Attack, its ideas had an important impact on Soviet thinking. Soviet doctrine began to change in response. Soviet doctrine began to change because of U.S. doctrine.

The Soviets began to write that it would be necessary to think of the conventional battle in new terms. Although they had already been writing about the military-technical revolution, the new American doctrine seemed to them to be particularly ominous. They were writing more and more that conventional weapons were more lethal than nuclear weapons.

For U.S. Army doctrinal thinkers as well as for the Soviets, the lethality of conventional long range weapons added a very important dimension to the way of thinking about combat. It was now possible to maneuver firepower and accomplish the same kinds of results as maneuvering ground units, maneuver by fires.

The Persian Gulf War was a validation of almost twenty years of thinking about the changing character of warfare. It validated both doctrine and weapons. Even the notion of the maneuver of fires as the way to begin combat was validated by the success of air operations against the forces in Kuwait.

Our problem is that wars have a tendency to use up doctrine and weapons. Enemies adjust. Enemies learn. In other words, simply because doctrine and weapons worked in the last war is the argument why they would not work in the next war, the paradoxical logic of war.

Here is where we begin to see another discontinuity on the horizon. If we think in terms of the trends of better information, more lethality and longer range and the consequence of lower density, we begin to see how we may have to think of density in new terms.

## Fragmented Battlefield

This new battlefield may be one in which to move is to be seen; to shoot is to be seen, and to be seen is to be hit and to be hit is to be killed. In other words, a commander can no longer be free to mass forces; he can only mass fires. The density of the battlefield becomes very low.

If the density of the battlefield becomes very low, the battlefield might be best described as fragmented.<sup>14</sup> A fragmented battlefield would be one in which units may not mutually supporting. It could become a battlefield more like those of the Civil War.

In a fragmented battlefield, warfare is very different. Maneuver warfare takes on a different quality. Encircling, for example, would not have the same kind of impact as it has had on the conventional, linear battlefield we have known since World War I. Leverage would be achieved in different ways. Leverage, for example, might be achieved by massing on a kind of target. The model might be the way in which the North Vietnamese massed on the target of provincial capitals during the 1968 Tet Offensive.

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<sup>14</sup>The U.S. Army talks about the nonlinear battlefield in much these same terms. I prefer to use the Russian (originally Soviet) term because I think it captures the essence of the battlefield.

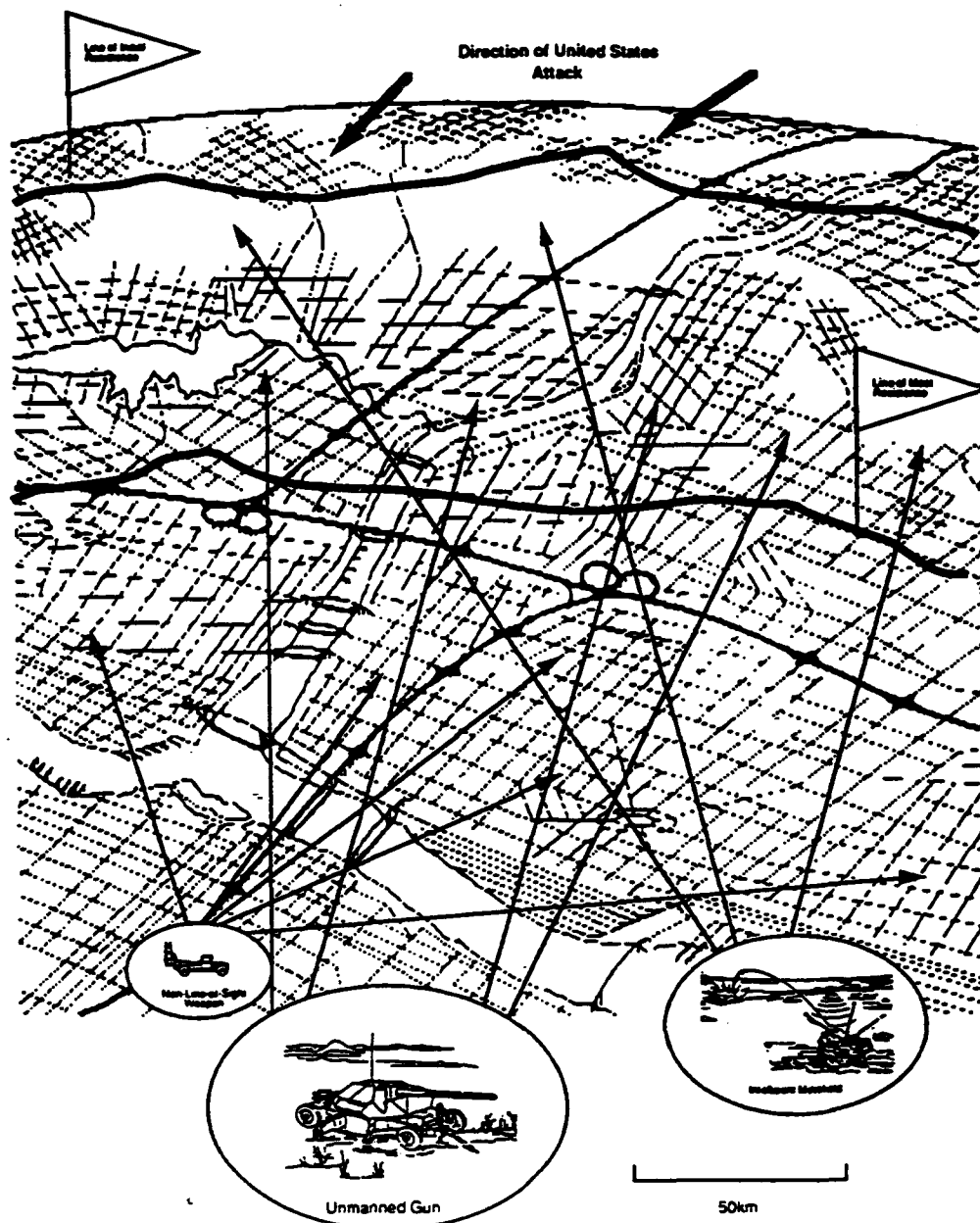


Figure 2. The Target-Poor Environment of the High-Technology Fragmented Battlefield

## NON-CONTINUOUS COMBAT

If the new battlefield is low density and fragmented, another discontinuity may be possible, non-continuous combat. In the linear, conventional battlefield

we have known since World War I, if the enemy attacked, you were forced to deal with the attack. In this new battlefield, commanders may refuse battle. Again, it appears as if we may be returning to more historic models. Lee could have decided not to engage at Gettysburg.

The other aspect of the discontinuities that begin to surface is that ground combat may become more and more like naval warfare. Refusing battle has been an important part of naval thinking almost from the beginning. The ocean provides a good model for the low density, fragmented battlefield.

### Tempo

This is the point where we can begin to see changes in some of the trends I described earlier. Tempo, as a characteristic of warfare, has been increasing for over 100 years. That trend may stop. If a commander can refuse battle, he can slow the tempo. He can decide the tempo.

In this emerging battlefield, if you move, you can be seen; if you shoot, you can be seen; if you emit, you can be seen; if you can be seen, you can be hit; if you can be hit, you can be killed. Rather than high tempo operations, it is easy to see how a commander would not risk his force until he sees the decisive time.<sup>15</sup> It is easy to see how this kind of warfare might be spasm-like.

### Logistics

An almost universal truth in warfare has been that more combat power requires more logistics, more tonnage of supplies and more people. We may see a profound discontinuity in this dimension of warfare. As precision warheads with single-shot, high-probability of hit and kill become standard for more and more weapons and deliver systems, less supplies will be required for a given combat power. In a low density battlefield, maybe with low tempo, units could move with their basic load being their battle load.<sup>16</sup> Resupply might be required for only fuel, water and food. If the battlefield were one in which maneuver is by fires, resupply might only be water and food. If units are operating out of cities, they might be able to operate independently.

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<sup>15</sup>In describing the commander's decision, I did not say decisive place on the battlefield. With extended ranges and low density, I think timing will take on a very different quality.

<sup>16</sup>Taking this to an extreme, I have seen calculations done showing that if DESERT STORM were fought completely with ground forces equipped with precision weapons, a single brigade could have the same killing potential as all the forces of the coalition.

## **Proliferation and Nuclear Weapons**

Even our conventional wisdom about proliferation begins to look not as certain as we see how the character of warfare might change. Again, before the Gulf War, the Soviets were writing that the lethality of conventional weapons was going to change the battlefield to the point where nuclear weapons would no longer play an important role.

Nuclear weapons are weapons best described as weapons of massed destruction, not mass destruction. If ground forces are dispersed, nuclear weapons have very little value against them. The low density battlefield is no place for tactical nuclear weapons and probably not chemical weapons.

## **Consequence for the Air Force**

As the combinations of technology and doctrine are pushed into the future, the picture that emerges is not a good one for the Air Force. It is certainly not a DESERT STORM. In ways, the profound problem for the United States Air Force will be to overcome a situation of its own creation. Airpower developments have changed, are changing and will change the character of war and warfare. Those changes will make it more difficult for the Air Force to influence the immediate ground battle. Those changes will make it more difficult for the Air Force to influence the ground battle through interdiction. In addition, limited objectives in war may make it less likely that conventional strategic bombing will be the policy choice.

## **PATHS TO THE FUTURE.**

Obviously, all militaries of the world will not select or be able to afford the high technology path to the future. There seem to be four paths. As the United States makes its choices, countries could respond in a parallel way, both with technology and doctrine. Countries could select weapons and doctrine that are direct counters. Countries could opt for passive counters. Countries could respond asymmetrically. Obviously, and probably, countries could respond with some combination. These options are expanded in Figure 3.

	Metaphor	Example
Parallel Development	Fighting fire with fire	Advanced fighter aircraft
Direct Counter	Fighting fire with water	Improved air defense
Passive Counter	Fighting fire by taking away the wood	Low density battlefield, dispersion
Asymmetrical Counter	Fighting fire with Smokey the Bear	Special operations

Figure 3. Alternative Ways of Responding to U.S. Developments in Technology and Doctrine

To have a more complete picture of possible futures, it's important to think about the lower cost response to the future. What would be the character of warfare if potential enemies were to select passive and asymmetrical responses to the trends? Would it be a different battlefield?

Interestingly, the answer is that it would be slightly different, but the defining characteristics would be the same. Even if you are responding in a low-cost way, weapon lethality will force lower density and dispersion. As in the high-technology response, lower and lower density leads to the fragmented battlefield. The fragmented battlefield moves towards discontinuous battle. Discontinuous battle is an attractive tactic for the technological inferior side, particularly against the United States. Low density and discontinuous battle mean less logistics requirements. The low density, discontinuous battlefield would dictate decentralization. Decentralization would reduce the fragility of units.

The passive, asymmetrical path would create the same problems for the Air Force. It would be a target-poor battlefield. It would be a battlefield on which the Air Force certainly would have less influence than in DESERT STORM. It could be a battlefield like Vietnam. North Vietnam used the same path to respond to technology.<sup>17</sup>

<sup>17</sup>OSD (Net Assessment) has been doing some work on what the future might be like, combining technology and doctrine changes. They have described my low technology response as the "gun

The extreme passive, asymmetrical response may not be a most demanding low-side boundary for us to consider. An enemy of light infantry with emerging technology weapons would be more dangerous. The capabilities against the United States might unfold as depicted in Figure x. We again see the paradoxical logic of war. If you can't match the United States developments, you can end up with greater military power if you move along another path.

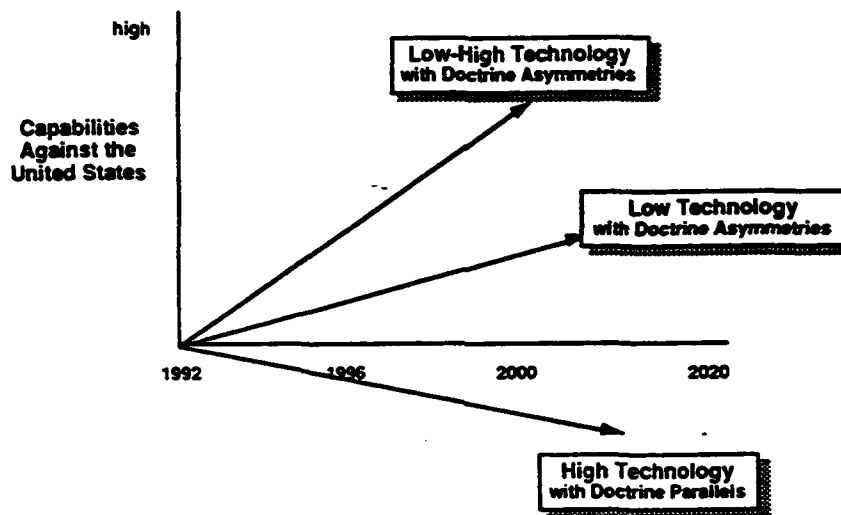


Figure 4. Graphical Representation of Potential Capabilities Against the United States

This battlefield would be difficult for the Air Force. It would be another target-poor environment:

fighter" option. I think that's pejorative. I think we need to see the low-technology option as a serious threat, a serious possible future battlefield.

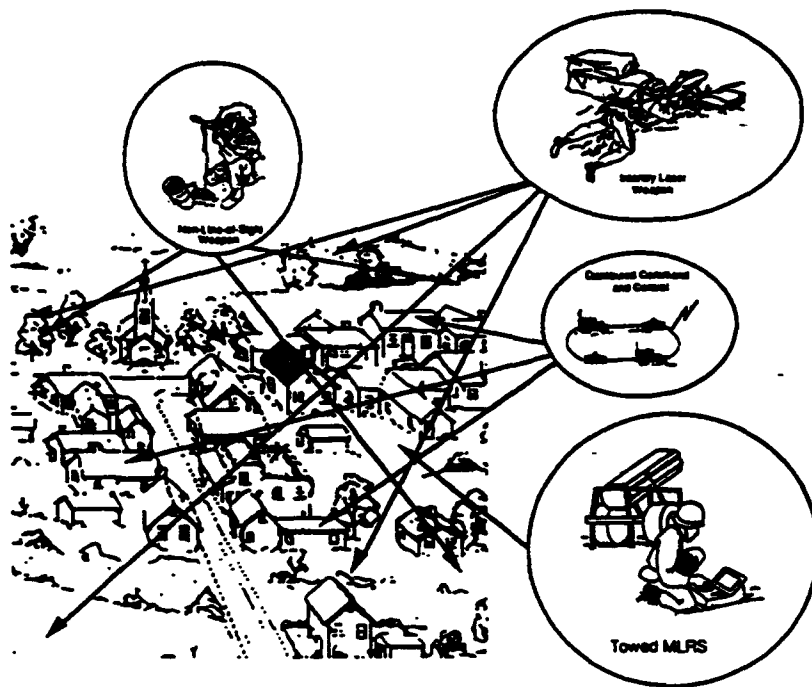


Figure 5. The Target-Poor Environment of the Mixed-Technology Fragmented Battlefield

#### A FRAMEWORK FOR FORCE DEVELOPMENT

Maybe it's not as complicated as I've made it. Maybe we will be lucky enough to fight another Saddam Hussein. Our problem is that maybe we won't. Maybe it is going to be a difficult future, hard to predict the national security environment and a more demanding battlefield. Maybe this is a new way to think about a worst case scenario. Maybe we are wrong to think in terms of the number of major regional contingencies and whether or not they are simultaneous or sequential. Maybe the worse case scenario is a reaction to our own strength.

The Air Force has always looked to the future. The strength of airpower is flexibility. Airpower has the flexibility to deal with the future. Does it? Speed, range, flexibility, precision and lethality - flexibility, it's right in the middle, one of the unique characteristics of the Air Force. That makes it easy. The Air Force is not only ready for the future. The Air Force is the future. What in the world is an Air Force to do? Press on.

Before we decide all we need to do is press on, we probably ought to look what flexibility means:

*Airpower's speed, range, and lethality allows rapid shifting of effects, concentrating firepower wherever the joint force command needs it -- from the close battle, across the length and breadth of the theater, to its deepest reaches. and Conventional airpower offers exceptional flexibility across the spectrum of conflict as an instrument of national resolve. The Air Force can deter, deliver a tailored response, or punch hard when required...*<sup>18</sup>

There are a number of components, then. Airpower can be shifted as the joint commander needs it. Airpower can be used across the spectrum of conflict. Airpower can punch soft or hard. Does that translate to being ready for the very limited objective war with a low logistics, low density battlefield? Maybe not. Maybe we need to expand our definition of flexibility. Maybe we need to add to the meaning of flexibility. Maybe we have to give flexibility a new meaning.

### Concept Flexibility

Wars consume concepts and doctrine. The ways of fighting the last war are almost never the appropriate ways of fighting the next war. Technology changes war. Nations learn from the last war.

At the beginning of the 1967 War, Israel attacked Egyptian aircraft parked on runways in the open. The world reacted. The Warsaw Pact embarked on an aircraft shelter program. NATO began building aircraft shelters. The world learned from the war. Israel had used up a concept.

Understanding flexibility means having thought through different ways of employing airpower. Understanding concept flexibility means appreciating that ranges of ground-based weapons will give concepts like "close air support" only meaning for historians.<sup>19</sup> Understanding concept flexibility means understanding that strategic deterrence and the linkage between strategic and conventional capabilities must be reformulated.

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<sup>18</sup>Department of the Air Force, "The Air Force and U.S. National Security: Global Reach - Global Power," (Washington, D.C.: Department of the Air Force, June 1990) p. 8.

<sup>19</sup>At the beginning of World War II, the British used the term "direct air support." It seems to me that in a battlefield in which engagements are at extended ranges, this term more clearly describes the use of air in direct coordination with ground forces.

Understanding concept flexibility may mean having thought about fighting a war in which the political objectives won't allow attacking the enemy cities and infrastructure. Understanding concept flexibility means having a concept for fighting a war against factions not controlled by central leadership. Understanding concept flexibility may mean being prepared to fight a low density enemy. Understanding concept flexibility may mean being prepared to fight a very low technology enemy. Understanding concept flexibility may mean understanding how to fight with low lethality. Understanding concepts must be flexible means understanding systems must be flexible. That's what an Air Force is to do.

### **System Flexibility**

The key to flexible concepts is flexible systems. If Air Forces systems are not flexible, the Air Force will not be flexible.

Understanding system flexibility may mean modernization is done in different ways. Understanding system flexibility may mean placing more emphasis on new subsystems rather than new aircraft. It means building systems to change. Understanding system flexibility may mean thinking of all aircraft as multi-role. That's what an Air Force is to do.

### **Unfolding Flexibility**

Readiness has been flying hours and training. Maybe we need to understand readiness in a different way. Maybe we need a long range view of readiness. Maybe we need to understand readiness as a quality that constantly unfolds as we move to the future. Maybe this is one of the new ways to think about flexibility.

A Service has never adopted an extreme investment strategy, but it is important to understand that the investment strategy does reflect some notion of beliefs about when the next conflict might begin. If basic research were to be the investment emphasis, that would suggest an assumption that the next war would be in 20 to 25 years. If aircraft procurement were the emphasis, the assumption

would be that the focus was 15 to 20 years. If the emphasis were on flying hours, the assumption would be that a war could begin at any moment.<sup>20</sup>

The idol of the immediate was a product of the Cold War. Understanding flexibility as a quality that is constant but unfolding mean a truly balanced investment strategy. Understanding flexibility as an unfolding quality may mean forgoing some readiness to allow for aircraft procurement. Understanding flexibility as an unfolding quality may meaning putting more emphasis on industrial agility. Understanding flexibility as an unfolding quality may mean forgoing force structure in favor of basic research.<sup>21</sup>

Understanding flexibility as an unfolding quality means seeing readiness as a long term quality. That's what an Air is to do.

### Intellectual Flexibility

The dilemma facing the Air Force is like the dilemma that faced Shell Oil in 1971. Shell's long range planners in London began to foresee dramatic and unpredictable changes in the world oil markets. The planners found that no matter how well they did their analysis and no matter how artful they presented their briefings behavior of the company managers was not changing. They were not preparing for the uncertain future.

The planners were able to make progress only when they began to see their task in a different way. "We no longer saw our task as producing a documented view of the future business environment five to ten years ahead. Our real target was the microcosm (the mental model) of our decision makers."<sup>22</sup> It was not until the planners saw their task as fostering learning rather than giving briefings and writing papers about the future that they began to prepare the company for the future.

The Shell planners used scenarios to educate. The operating managers were encouraged to think how they would manage under very different oil markets. It didn't matter if they believed the market was going to move in that

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<sup>20</sup> Although it would seem an emphasis on spares would suggest immediate readiness, because of the delay between order and deliver, emphasis on logistics would be a 3 to 5 year focus.

<sup>21</sup> A description of the alternative branches for restructuring the technology base is in a paper, Office of Technology Assessment, Congress of the United States, *Building Future Security: Strategies for Restructuring the Defense Technology and Industrial Base*. June 1992.

<sup>22</sup> This is from P. Wack, "Scenarios: Uncharted Waters Ahead," *Harvard Business Review*, September-October 1985. pp. 73-89.

direction. How would you respond if the market did move in that direction? The planners taught the company to be mentally prepared for an unpredictable future, to shift from low prices to high prices, from stability to instability.

Understanding flexibility as a quality of leadership means seeing planning as a teaching function. Understanding flexibility as a quality of leadership at all levels means preparing Air Force people to think about the use of airpower in different situations in different ways. Understanding intellectual flexibility as a quality of leadership means understanding it may not be as important to have the right strategy as it is to foster strategic thinking.<sup>23</sup> That's what an Air Force is to do.

Intellectual flexibility is the fundamental requirement for an uncertain future. Douhet said, "To prepare for war demands, then, exercise of the imagination." To prepare for an uncertain future requires the exercise of imagination. Preparing the Air Force for an uncertain future demands giving new meaning to the flexibility of airpower. That's what in the world an Air Force is to do.

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<sup>23</sup> An excellent article on the distinction between strategy and strategic thinking was written by Henry Mintzberg, "Crafting Strategy," *Harvard Business Review*, July-August 1987, pp. 66-75.

## What in the World is an Air Force To Do?

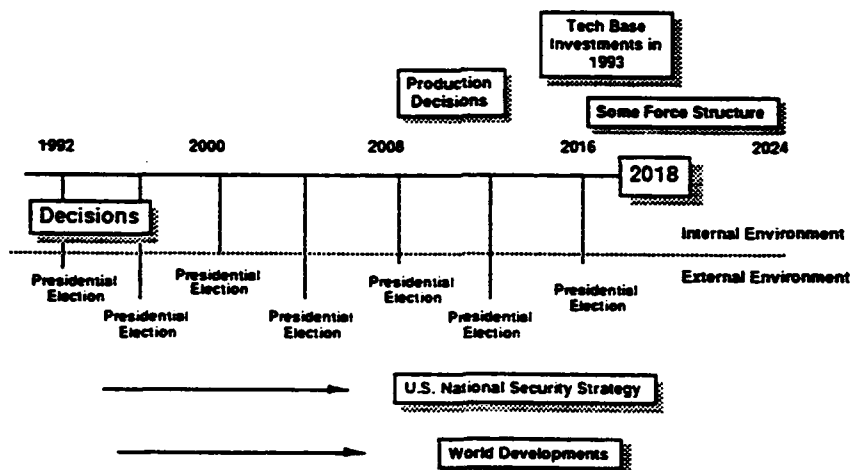
Aerospace Power's Role in American National Security in the Next Quarter Century

What are the Long-Term Lessons of History that Deserve a Leading Role in Determining How We Define our Aerospace Futures?

Sam Gardiner

March 16, 1993

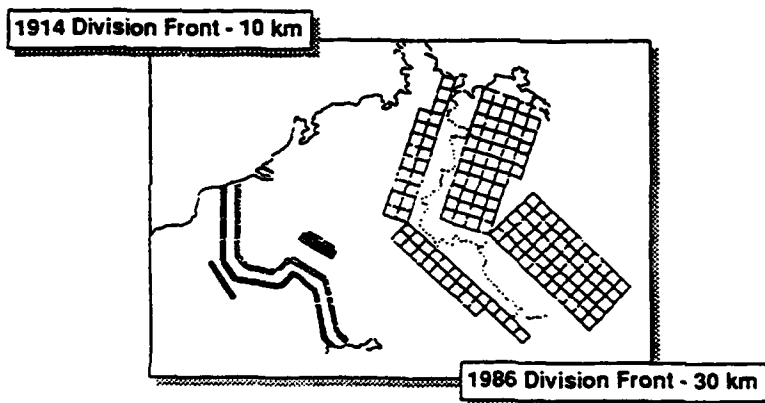
## The Dilemma of Envisioning the National Security Environment



## From Changes to Trends to Aerospace Futures

Changes in War & Warfare	Trends	Discontinuities
Causes of War	Campaigns	Deterrence by Punishment
Limited Objectives	Asymmetrical Technologies	No Linkage Between Conventional and Strategic
Non-Forward Deployment	Fragility of Targets	Asymmetrical Objectives
Information Content	Fragility of Units	Asymmetrical Vulnerabilities
Lethality of Weapons	Interchangeability of Delivery Systems	Fragmented Battlefield
Range of Systems	Increased Tempo	Lower Logistics
Proliferation	Battlefield Density	Noncontinuous Combat
		Lower Tempo

## Battlefield Density



This is from Chris Bedamy, *The Future of Land Warfare*

## Logic of Warfare

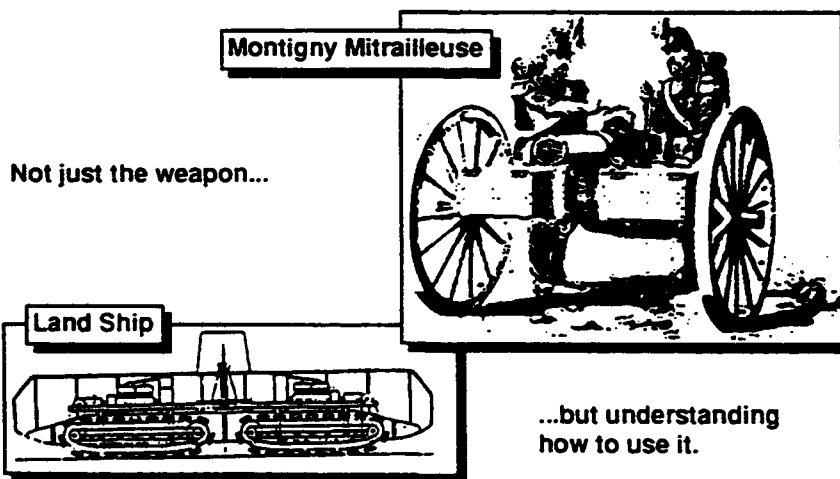
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With each side seeking to achieve his objectives while preventing the other from doing the same, war consists in large part of an interplay of double-crosses. The underlying logic of war is, therefore, not linear but paradoxical. The same action will not always lead to the same result. The opposite, indeed, is closer to the truth. Given an opponent who is capable of learning, a very real danger exists that an action will not succeed twice because it has succeeded once.

Martin van Creveld

## Role of Doctrine

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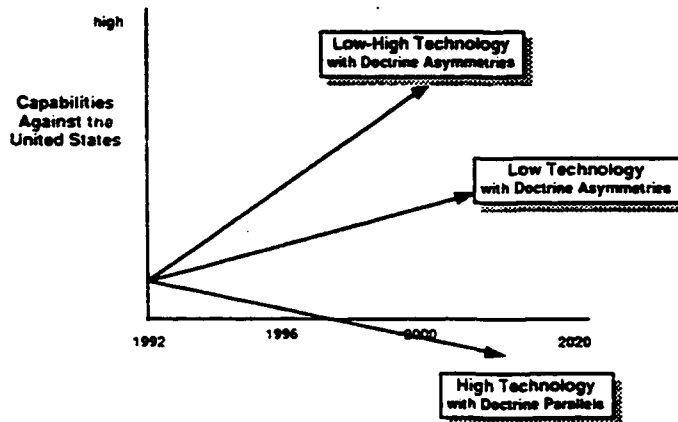


## Reacting to US Capabilities

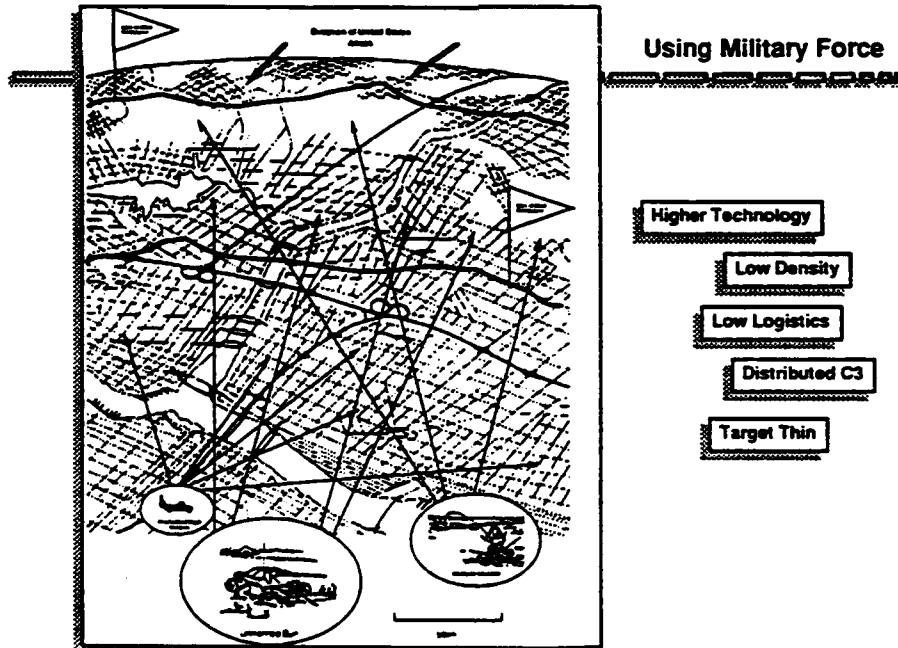
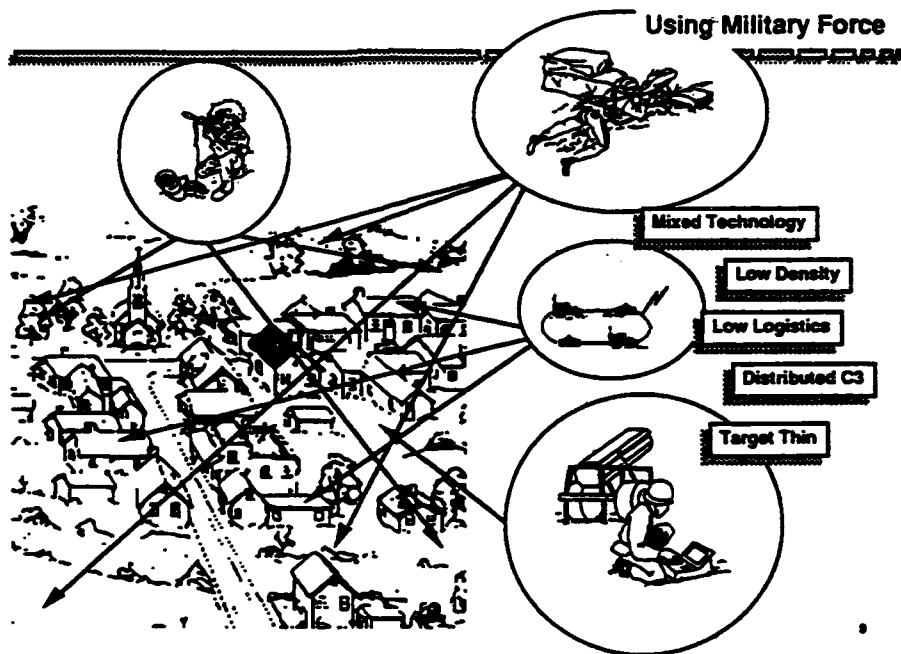
	Metaphor	Example
Parallel Development	Fighting fire with fire	Advanced fighter aircraft
Direct Counter	Fighting fire with water	Improved air defense
Passive Counter	Fighting fire by taking away the wood	Low density battlefield, dispersion
Asymmetrical Counter	Fighting fire with Smokey the Bear	Special operations

7

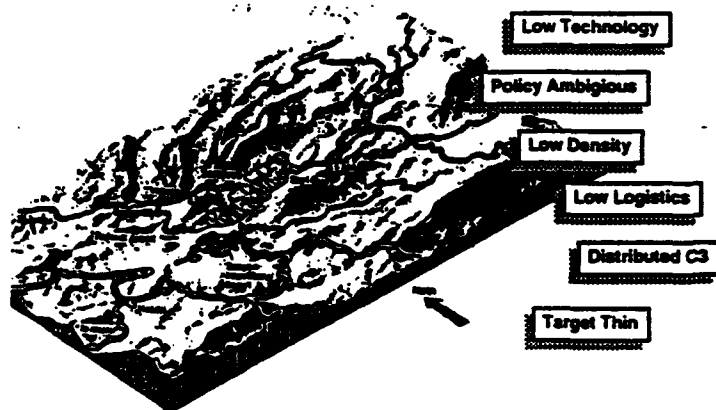
## Reacting to US Capabilities



8



## Using Military Force



11

# **Aerospace Power's Role in American National Security in the Next Quarter Century**

## **Direction and Pace of Aerospace Technology**

**R. S. Colladay**

American industry has been undertaking a dramatic modernization to become more productive and competitive in the global market -- maybe somewhat reluctantly at first, but it has been going on in earnest for the last five years. While commercial segments were the first to get the wake-up call, I can assure you that the aerospace-defense industry is in the midst of the same gut wrenching overhaul, the likes of which has not been seen in half a century.

In this environment of downsizing in response to a declining defense market, the clarion call is: improve productivity or perish. Only the survivors will figure out how to offer quality products, at lower cost, in less time.

It used to be that the most interesting aspect of change was to look at the new platforms enabled by technology breakthroughs. Now, how we do things is going to change even more dramatically than what we do. The message being that new hardware, whether it is aircraft, spacecraft, or other weapon systems, has become so expensive and takes so long to develop, that the reduced budgets we are facing will require that we get more out of existing platforms.

Continuous improvement in all processes is undergoing relentless attention to improve quality and drive down cost. Of course, continuous improvement requires continuity of activity and until the current "rightsizing" of the industry runs its course, you will not fully realize learning curve and process improvement gains. Program starts and stops, cancellations, stop-work, stretch-outs, build-outs, slow-rate production make a tough environment for continuous improvement.

In all my years, both inside and outside the Government, I have not seen as much "stutter stepping" as exists today. We never seem to have the will to finish anything. I think that is because programs are

stretched over so many years that the political support for them can not be sustained. In DARPA, we tried to design programs that could be completed within three years. If a program exceeds four years, it very likely will span two administrations and three different sessions of Congress. That requires a lot political capital to be expended to keep the program sold. NASA's Space Station is a good example of the difficulty. Then there are programs like Brilliant Pebbles. We would have to produce it instantly to avoid being a political target!

How are we going to do things faster, cheaper, and better? For one thing, concurrent engineering -- doing things right the first time, one time -- will be taken to a new level in the next 25 years with virtual reality. Imagine, designing the piece parts of a product, suit up with tactile sensor gloves and visual display helmet, pick up the parts and assemble the system. Is there an interference fit? Go inside and find the problem, change the design, and go on. Is there an optical path distortion? Ride a photon through the optical train and correct the design. Is it a tough part to manufacture? Simulate it and modify the design.

New systems will be procured and developed by simulating before building, prototyping before producing. Simulation and prototyping will be up to a system-of-systems level, where we will be able to evaluate operational performance before production. The current warbreaker program and the National Test Bed Facility for missile defense are previews of what is to come. We should carry the "silver bullets" -- the best of the best in technology -- to the point of building operational prototypes that can be fielded and evaluated in a realistic environment.

Turning to operations, collecting data, fusing it from multiple sources, converting data to information, and disseminating it in a timely way to the people who need it is the highest leveraged activity that we can undertake to make our systems more effective. Higher data rate communications, optical transmission, high-definition displays, high-speed processing, and software advances will contribute to making this an information rich age.

If information can go to people to interpret, it can also go to neural network computers that control robotic devices and automated pro-

cesses, enabling more capable autonomous weapons and unmanned vehicles. Smart, precision weapons will become brilliant as electro-optical sensors increase their spectral domain and on-board processors achieve teraflop speeds in sizes smaller than a soup can.

Carrying miniaturization one step further, breakthroughs in nanotechnology applied to micro electro-mechanical devices will usher in a whole new dimension in control systems for various critical processes, fluid flow stability, and robotics.

Technology of miniaturization will also fuel the trend towards more capable small satellites offering a cost effective approach to distributed surveillance and remote sensing from low earth orbit. As an example, the miniaturization technology developed in the Brilliant Pebbles program for missile defense is leading to a 16-fold reduction in weight, 8-fold reduction in size, and a 4-fold increase in on-board processing speed in space-based interceptors. Not only that, the program is tackling what it takes to design spacecraft that are highly producible -- something you have to consider big time when you plan to build thousands rather than the usual one or two of a kind.

I can not leave this subject without noting that we have the technology to deploy a missile defense system to protect the US, our allies, and other interests overseas, and do it affordably, but we are not much closer to realizing it. In fact, with the program cuts SDIO has been forced to take in this last round, we are retreating. If a firm requirement and the technological know-how are not matched by the political will to act, there is little progress. Twenty-five years from now will we still be defenseless against a missile attack? Will we have the ability to control our interests in space? As an aerospace engineering manager, I am frustrated by not being able to get on with it. As a US citizen, I am appalled that we should be left so defenseless.

Let me address another point that is a popular notion these days, and that is technology can be developed and put on the shelf until it is needed. That sounds good in budget cutting exercises, but in reality, technology has a shelf life of about 2 years. I have tried to resurrect engineering databases, technical expertise, and materials, and believe me, it is harder than you think. Beyond 2 years, it is almost like

starting over. In this day and age of shrinking workforces, the expertise is very likely gone from the company.

Reflecting on where we have been and where we are going, progress no longer seems to be paced by the technical achievements of the scientists and engineers in the laboratories, but rather by the planning, budgeting, and procurement process itself, excessive oversight, and an arms-length, frequently adversarial relationship between industry and government. If these inhibitors are not removed, the next 25 years will be all too easy to predict.

Putting that warning aside, and being the eternal optimist that I am, I believe that we will streamline the acquisition process, the aerospace industry will be rightsized and profitable, and technology breakthroughs will occur that will take us in new directions that we can not even begin to imagine. In 25 years, we are good for a few breakthroughs that make the kind of projections I have attempted here the laughing stock for speeches in 2018. But when all else fails remember this: Things are more like they are now than they ever have been before -- and ever will be again!

***Industrial Base  
And  
The Future Of U.S. Aerospace Power***

Presented To:

Conference On Aerospace Power's Role  
In  
American National Security In The Next Quarter Century

March 16, 1993

Richard Hardy  
Vice President, General Manager  
Military Airplanes Division  
Boeing Defense and Space Group

# **INDUSTRIAL BASE AND THE FUTURE OF U.S. AEROSPACE POWER**

- **Introduction**

Thank you for the opportunity to speak to this distinguished group. We, in industry and in government, are struggling with the problem of maintaining the advantage the U.S. enjoys in aerospace power while reducing the size of the military and the industrial base. The fact that the industrial base will decrease is not the question, rather it is how this reduction should occur and what actions do we need to take to retain capabilities critical to our national defense.

- **Three points:**

- **Base is shrinking**
- **No WPA**
- **Innovative, value added new projects**

I would like to share some thoughts on what we need to do from my vantage point in industry. The initial thoughts are about the industrial base decrease, then I will discuss some actions that interfere with an efficient process of decreasing the base, and last, suggest a path that would focus and aid the process of maintaining a viable defense-industrial base.

The new administration along with the nation, is working mightily to establish a new consensus for its national security policies, priorities, and budgets. This is a difficult but essential step to provide a stable framework for future defense planning.

I will leave the broad defense policy issues and scenarios for possible future conflicts to those experts who are participants in this symposium. How these issues are resolved have important implications for the size and composition of our military forces and ultimately the defense industry. Until the policy framework is established which balances defense needs with domestic programs and pressures to reduce the deficit, we will not know where the defense budget will go in its downward course.

## • **Shrinking Base**

Since the highwater mark in 1989, aerospace industry employment decreased 20 percent by the end of 1992 or over 250,000 people and likely will decrease a similar amount in the next few years. In 1989 there were eight military airplane manufacturing companies, presently there are six, and I can see where in a few years there could be only three.

As we undergo reductions in industrial capacity, industry must increase its efficiency and productivity to remain viable. The immediate challenge is to control overhead expenses as programs are stretched or unexpectedly cancelled. This task must be accomplished even though it is difficult to reduce excess capacity as rapidly as the business base is shrinking, especially when large, complex facilities, such as production plants, laboratories, and radar ranges, are in question.

As industry is downsizing, it still has the challenge to meet its contractual commitments on performance, schedule, and cost on existing programs. This is a tough challenge, but I believe, one which industry ultimately will meet.

As the defense business sector does shrink, one area of concern for all is the U.S. commitment to technology growth. The government must follow through on statements of good intentions with real investment in technology growth. Innovation and technology infusion are two of the greatest levers we have in fielding decisive combat capability. As our forces are reduced, technologically superior weapons systems will increase in importance to the U.S. ability to achieve its military and diplomatic objectives.

- **No WPA**

From industry's perspective, I want to share my thoughts on how this effort to reduce the defense industrial base can get off track. First, the defense industry should not seek extra-ordinary relief from the government. The government should permit the industry to adjust to a much smaller market. This adjustment translates as no handouts, no sustaining contracts for unneeded goods or services. Though there are a few technologies which represent unique defense industrial capabilities that may require support, we should guard against subsidizing weak, inefficient operations. Ultimately, market forces will determine the composition and size of the industry and we should be wary of interfering with that process.

- **Cost-share, Risk**

The government can help put their future programs on a solid footing by making research and development profitable. In attempting to execute this policy, I would offer a few suggestions. Fixed priced development contracts should be abandoned. It is not healthy to use this type of contract where technology development risk is present. Similarly, cost share should not be requested. It should be recognized that organizations such as DARPA still put out Request for Proposals that ask for cost share. There are also people in Dayton who think that they are doing the country a service by getting contractors to cost share on research contracts. In a similar manner, precontract risk should be avoided. The government should prepare its paperwork and pay its bills on time. The government would also be well served to insure that the acquisition community does not encourage buy-ins. Though a buy-in may solve an immediate funding problem, the experience of the 80s shows that "buy-ins" result in downstream cost overruns, schedule slides, and recriminations.

Both industry and government have studied our technology requirements and created long lists of needed technologies. The challenge to government is to establish a research and development environment which encourages technology growth with recognition that there may be no large follow-on production programs. Procurement regulations that limit profit rates and incentive fees need to be revised to allow research and development work to generate profits necessary to cover productivity investments and to provide a fair return on capital. As this audience is aware, industry historically has invested significant resources of its own in company sponsored independent research and development and cost sharing during early phases of programs such as the Advanced Tactical Fighter. These investments were justified in the past because profits earned during follow on phases provided an adequate payback over time. However, with few large production runs in the future, the government needs to assume the risk and provide increased incentives for research and development work in light of reduced production opportunities.

- **Army of Auditors**

The government should weigh carefully the costs of its extensive oversight activities against the value returned. I don't believe the Air Force or the Department of Defense realize how much of a burden its audits place on industry. For example, our studies show that we need 5 times as many finance people per dollar of sale on government contracts as on commercial contracts. These finance people are on overhead. In addition, I doubt that the number of auditors has declined at the same rate as the defense budget or the industry workforce.

## • **Tailored Specification and Documentation**

As we consider further the changes in the Defense Departments acquisition strategy, we are challenged to improve our business methods to achieve efficiency and cost savings. A case in point is the rollover plus concept, where many new EMD programs won't go into production. In order to lower the cost of prototyping and developing new systems, congress, the DoD, and the Air Force should reexamine the specification and paperwork requirements associated with development contracts.

Some of the statutorily-imposed acquisition strategy, execution, and reporting requirements which currently apply to category I Major Defense Acquisition Programs have evolved in response to problems or circumstances which no longer exist and/or dictate specific solutions which are now outdated. For example, the MIL-Q-9858A Quality System has been imposed on all Category I development programs since the 1960s. Industry is now designing quality into products and processes, and using different techniques to continuously improve upon the baseline.

Literally hundreds of CDRL reports are required during the execution of an EMD program (even after the DoD has tailored the standard list). Very few of these add anything of real value to the actual design process. If you looked at all that paperwork a couple of years after an EMD program was "put on the shelf", very little of it besides documentation of the configuration baseline would be useful to actually initiate production.

## • **Commercial Practices**

Another change with potential to offer significant efficiencies and savings is the acquisition of commercial products to meet military requirements.

This concept has been endorsed by prominent study groups such as the Packard Commission as well as in a recent Department of Defense white paper entitled "The Defense Industrial Base". It has even been written into law. The fiscal year 1990 Defense Authorization Act directed the Department of Defense to remove regulatory barriers to the acquisition of commercial items.

Yet the impediments remain. Some examples include complying with government accounting requirements and audits which add unnecessary time and costs. Many government acquisition officials are afraid to give up the crutches of military specifications and standards. As a result, attempts at commercial type acquisition are frustrated.

Excessive technical data requirements which infringe on the proprietary data rights of industry and unique government contract requirements such as mandating that socioeconomic provisions be met by second and third tier suppliers add cost, but little real value. Indeed, over the past several years these requirements have driven thousands of second and third tier suppliers out of defense business. Unless positive actions are taken, these obstacles will continue to impede the military use of products that are developed, priced, and produced in quantity for the commercial marketplace.

- **Innovative, Value-added, New Projects**

Industry is perceptive and, with full and open discussion with the government, it can understand the major changes the military is undergoing and hence reorient itself to meet new product requirements. It is incumbent upon industry to recognize the shifts in requirements and adapt appropriately. For example, from strategic nuclear systems toward conventional precision strike, increased reconnaissance needs, and a reliable, low cost space launch system. It is industry's responsibility to figure out how to redeploy its people, its research efforts, and its investments to meet the changed needs of its government customers.

With the shared goal of maintaining a viable defense industrial base, both government and industry should investigate and pursue new product areas that maintain the aerospace industrial base to the benefit of military capability. What industry would like to see emerge are solid, value added programs which meet Air Force fundamental mission needs. Likely candidates are:

- New attack aircraft
- Precision weapons
- Advanced avionics architectures
- A new space launch system
- Advanced reconnaissance systems
- Theater missile defense

The point is that future programs which are started purposefully and placed on solid foundation will size the industrial base in the most economically efficient manner. In addition, it should be recognized that there are synergisms between military needs and civil program initiatives. For example, expanded research on subsonic and supersonic aircraft can yield great dividends to the commercial market place. On the other hand, commercially derived transports have the potential for addressing military needs at much lower cost and with a very flexible world wide support system. Similarly, space launch systems development can gain back to the United States the commercial market lost to foreign launch systems while increasing the U.S. capability to access space as another theater of operations.

There are many other examples of synergistic technologies and programs. It is to the mutual benefit of the government and industry and the national economy as well to exploit the shared benefits fully.

It should also be recognized that we are achieving success in improving the development process itself. We are undergoing a cultural change in the way we manage programs. We establish overall goals and specific objectives for a program, and then empower the people on integrated product development (IPD) teams to get the job done. On programs like the F-22, the Air Force is joining the IPD team for an interactive exchange of information and guidance. Rather than relying on an adversarial relationship and a long list of reports, this approach matches the customer interaction and oversight with the management systems which are evolving to maintain industry's competitiveness.

Finally, as we look toward the future and try to figure out how to maintain a strong and responsive defense industrial base, I would encourage the Air Force to look favorably at and, where appropriate, pursue joint programs with our allies. By this approach we expand the market for industry's product as well as the resources available to support development.

## • **Summary**

Industry must size itself to the market. During this process, industry will have to emphasize efficiency and productivity to remain competitive. Government should aid this process but not waste money or insert itself in ways that interfere with the market forces.

Continued technology development in defense related areas will depend more directly on the government for financial support and focus. This is a critical area where the Air Force, the Defense Department and the Congress need to implement their intentions to maintain their commitment with funded programs. The worthy goal is to insure U.S. technological superiority without financially weakening industry.

As the defense budget is reduced it is important to focus our industrial efforts on useful products. There are a number of development opportunities which hold the potential to benefit both the commercial and military sectors of the economy. These projects deserve greater emphasis as we strive to compete internationally with our products and maintain a cutting-edge military capability.

We have won the cold war. The nation is in the process of a fundamental restructuring of our defense policies and goals to maintain our security and to prosper in the next century. If cooperative efforts between government and industry can be implemented, then industry can respond and prosper in an austere environment. The American defense industry can adapt to the new environment, can invest to make itself competitive in the international economy and will provide the U.S. military with the equipment, the services, and the technology necessary to keep the country both secure and solvent.



# **Industry's Role in U.S. Aerospace Superiority: Some Policy Recommendations.**

**Dr. Ronald D. Sugar  
Vice President, Group Development  
TRW Space & Electronics Group**

**Aerospace Power's Role in American National Security in the Next  
Quarter Century**

**sponsored by  
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**at the request of  
Lieutenant General Buster C. Glosson, USAF  
DCS Plans and Operations, HQ USAF**

**Crystal Gateway Marriott Hotel  
Tuesday, March 16, 1993**

## **Industry's Role in U.S. Aerospace Superiority: Some Policy Recommendations**

**Remarks by Dr. Ronald D. Sugar  
Vice President, Group Development  
TRW Space & Electronics Group**

**March 16, 1993**

**"If you want to know when a war is coming, just watch the United States. When they start cutting down on their defense it's the surest barometer in the world."**

**(Will Rogers)**

Today we are most likely in an "interwar" period - not just in the "post-Cold War" period. The Cold War was a unique era in history. It is done. But if history is any guide for the future, we must be prepared for whatever comes next. We must ensure that the U.S. retains absolute aerospace superiority - so that U.S. military power remains unchallenged.

To deter the next war - and if necessary to fight and win it - the U.S. will depend upon forces that are smaller, lighter, and more mobile. They will more likely be based in the CONUS. They will be staffed with motivated professionals who are better educated and better trained than ever before. They will rely on high technology weapons, and on the "high ground" of space for command, control, communications and intelligence; surveillance; weather; and navigation.

However, the ability of the U.S. industrial base to provide these high technology weapons and space systems is now severely stressed. The aerospace/defense industry is being hit by rapidly declining DoD budgets, by lack of a long-range strategy for defense investment, and by a complex and adversarial procurement process.

With declining budgets, the U.S. industry now has far more capacity than may be necessary for future national security requirements. Too many companies are competing for too few programs. Many companies have an inadequate business base for economies of scale and efficient operation. So the industry is undergoing a permanent restructuring. It is rationalizing through downsizing, divesting, strategic teaming, diversification, and consolidation.

History shows that the U.S. has downsized its defense industrial base poorly after major military buildups. We did poorly after World War 1. We were numerically and technologically disadvantaged compared with Germany and Japan in the late 1930s and early 1940s. We did the job poorly again after World War 2. We became overextended and unprepared for the invasion of South Korea in 1950. We did so yet again after Vietnam. We found ourselves with a "hollow army" in the late 1970s - which, combined with Soviet expansionism, led to the requirement for the massive defense buildup of the early 1980s.

After World War 1 and World War 2 we had "reconversion" back to civilian production, after a few years of massive defense production. We had a growing economy fueled by pent-up civilian demand. But this time, it is different. This time we are coming off a 40-year "buildup," with much more sophisticated and militarily-unique technologies. We have a less robust civilian economy. This time, it is not reconversion. It is permanent economic restructuring.

This time, in downsizing the defense industrial base, let's do it smarter. To deter the next war - or if deterrence fails, to win it - our military forces will need advanced technology for force multiplication and projection, and to maintain information superiority for communications, intelligence, surveillance, and early warning. This advanced technology depends upon a robust, healthy industrial base.

Why is a healthy aerospace industry important to this nation's future security? It is industry that must stand ready to produce the future weapons necessary. The job cannot be done by the National Labs and Federally Funded Research & Development Centers (FFRDCs) alone. Moreover, today's aerospace industry is of itself a source of U.S. economic strength and global competitiveness. A healthy, downsized industry will continue to have that attribute.

(The following data are from the McKinsey & Co. study "California Aerospace 2000," October 1992)

The aerospace industry is one of the nation's largest sources of employment:

<u>Industry</u>	<u>1992 Employment (\$ billions)</u>
Aerospace	2.3
Construction	1.7
Motor Vehicles	1.2
Chemicals	1.1
Apparel	1.0
Rubber & Plastics	0.8
Computers & Office Equipment	0.7
Textiles	0.7

These jobs in turn support indirect jobs in suppliers and dependent trades and services - McKinsey estimates the "multiplier" at 1.5 to 1.8 additional jobs for every direct job.

The aerospace industry is a major source of U.S. trade surplus, particularly commercial aircraft, but also defense systems:

<u>Industry</u>	<u>1991 Trade surplus or (deficit)(\$ billions)</u>
Aerospace	27.2
Chemicals	18.8
Scientific Instruments	6.7
Telecom Equipment	(13.5)
Clothing	(23.0)
Vehicles and parts	(39.4)

U.S. aerospace industry participation in foreign military initiatives provides the U.S. with intelligence and facilitates U.S. involvement (through weapons system inter-operability) in political solutions for the greater good. If we are not a player, it is more difficult to steer.

The industry is a source of quality, high wage jobs, for a well-educated work force. It requires a high involvement of the educational "pipeline" both for new hires and for continuing education of its work force. It in turn supports education at all levels.

The industry employs an increasing percentage of women and minority workers. The aerospace industry also supports small and disadvantaged businesses. It supports local social services and the arts. In my own company's Space & Electronics Group, for example, 27 percent of our professional staff and 33 percent of our total employees are now minorities.

So, in downsizing the aerospace industrial base, can we do it smarter? Here are 10 policy recommendations:

**First**, reduce defense spending in an orderly way. Precipitous downsizing has severe ramifications, some of which could be irreversible, particularly in states like California that have a large share of the industry. An orderly downsizing will minimize dislocations and maintain the economic viability of industry participants. This will allow time for transfers and retraining of skilled people. Give us greater stability in planning, particularly in key anchor programs. Give us some stability and industry can do its part.

**Second**, downsize the large government bureaucracy that oversees defense procurement, provides services, and conducts research and development. Downsize it at least as rapidly as the private sector is downsizing. Perhaps even faster. To do anything less will further impede progress.

From its peak in fiscal year 1985 to fiscal year 1992, total defense budget authority in constant dollars has declined by almost one-quarter. Defense procurement budget authority in constant dollars has declined by one-half. The experience of my own company and others has been a 40 percent reduction in employment. Yet the number of people in the DoD acquisition work force is up by over 12 percent (refer to chart). What is wrong with this picture?

	<u>FY 85</u>	<u>FY 92</u>	<u>% change</u>
DoD TOTAL Budget Authority (Constant FY93 \$)	376	287	-24%
DoD PROCUREMENT Budget Authority (Constant FY93 \$)-	127	63	-50%
DoD acquisition work force	183,044	206,064	+12%

SOURCE: Budget Authority figures from DoD National Defense Budget Estimates. DoD acquisition work force data from a speech by Bernard Schwartz, Loral Corporation, based on information from the Defense Management Data Center.

**Third**, maintain a healthy balance between work performed in private industry and in the R&D, production, and maintenance activities of the government. These are the National Labs, Depots, and Federally Funded Research & Development Centers (FFRDCs). Don't displace industry jobs in Depots. Industry involvement in Depots and Operations & Maintenance (O&M) work serves as an important link to the needs of military end users, and encourages Pre-Planned Program Improvement (P3I) opportunities. Don't displace industry jobs with new "charters" for government labs. For example, several national laboratories are now expanding into work traditionally done well by industry, such as satellite design and integration. This is not defense conversion. This is de facto nationalization of the industry. This will not serve America's need for aerospace superiority.

**Fourth, while downsizing, streamline and fundamentally restructure the procurement system for the realities of the 1990s. In comparing the environment of the 1980s with that of the 1990s, (refer to chart)**

	1980s - What expanding defense budgets brought us:	1990s - Necessary responses for the new realities:
Competition	expand competition to control costs (and share the wealth)	encourage collaboration to ensure survival of core capabilities
Industry base	get more companies involved, multiple sources	shake out and rationalize to retain critical mass
Procurement approach	Congressional criticism encouraged adversarial relationship	TQM and cooperation essential
Procurement process	accrete procurement "reforms" and complexity to control fraud, waste, and abuse - oversight stifles efficiency and saps resources	simplify and restore trust to improve efficiency and reduce costs
RDT&E	encourage industry to subsidize RDT&E - payoff in large scale production	properly fund and incentivize RDT&E to preserve continuity of critical capability

**Fifth, overhaul DoD laws, regulations, and practices.** These include accounting requirements and audits, specifications and standards, technical data requirements, government-unique contract requirements, and security. There have been many recent suggestions for reforms. As just one example, in the security area, someone has estimated that there are over 1,000 specialized security systems. We support the effort underway to create a single unified security system.

**Sixth, stimulate investment in the U.S. private sector - including the defense industrial base - through tax, trade, and regulatory policies, such as R&D tax credits.** This is a broader issue for overall U.S. industrial competitiveness.

**Seventh, allow adequate profitability on RDT&E itself.** Change the practice of the 1980s of encouraging large profit investments by contractors in the R&D phase in hope of subsequent large production runs. There will be few large production runs, and profits have often proven elusive. In a market economy, capital will move out of arenas in which it cannot make an adequate profit. Fair returns on RDT&E work will encourage continuing capital investment in defense work.

**Eighth, maintain an adequate stable production base, including subcontractors, suppliers, and vendors.** We cannot expect to develop a prototype, and put it on

the shelf, then be able to move quickly into massive quantity production. On some systems we must maintain an sustainable level of production, to retain production capacity and skills. Manufacturing know-how is in itself a critical technology. It is just as important to aerospace power as research and development.

**Ninth**, where dual-use technology *is* applicable, "lighten up" on regulation and oversight which limits outside profit. It is in the U.S. government's interest to encourage flourishing, dual-use commercial applications. Profitable dual-use technologies translate into U.S. aerospace power. Also, proactively assist U.S. industry in exporting, and in international cooperation arrangements, for world-competitiveness. And finally,

**Tenth**, in the military-unique technologies where dual-use *is not* applicable, we must recognize the industrial base implications of future procurement decisions. Whether intended or not, upcoming major competitive awards will essentially define in a de facto sense the DoD's "industrial policy." Therefore, it will be important to keep an eye on the health of certain centers of excellence for military-unique technologies. In some cases, it may be necessary to directly support the unique work performed in such companies.

In summary, as U.S. aerospace power is preparing to deter - or to fight, if necessary - the next war, let's remember that:

- Technological advantage differentiates America militarily.
- Technological advantage can only be maintained with a strong industrial base.
- Preserve the industrial base that provides that advantage.

If the right policies are put in place, industry will step up to the challenge!

The author wishes to acknowledge the research contributions of John A. Mellen in preparing this paper.

LT GEN MOORMAN

CONFERENCE ON  
"AEROSPACE POWER'S ROLE IN AMERICAN NATIONAL SECURITY  
IN THE NEXT QUARTER CENTURY"

CRYSTAL CITY, 16 MARCH 1993

THE "SPACE" COMPONENT OF "AEROSPACE"

Thank you, Colin. Good afternoon General Carns, General Glosson, General Odom, ...[?]. It's a pleasure to be here at what clearly has already been an important exchange of ideas on the future of aerospace power.

Introduction

I've been asked to speak about the prospects for the "space" part of "aerospace." The foundation of the Air Force, certainly, is airpower -- Sputnik didn't come along until 54 years after the Wright brothers' first flight and 10 years after we formally separated the Air Force and the Army. So it's no surprise that our air component is well ahead of our space component.

That gap has stayed fairly wide for a number of good reasons, not least of which are the tremendous success and effectiveness of modern airpower and our proper priority of putting iron on targets. Other reasons include the technology demands and relatively high costs of accessing and operating in the "new" environment of space. And there are cultural and organizational barriers that take time to overcome.

The difference now in the 1990s, especially with our DESERT STORM experience, is that we're gaining a better appreciation throughout the Defense Department for just how valuable space really is to national security.

General Glosson just spoke about organizing, training, and equipping the Air Force for the next war and for the next century. And, as he noted, everything in his remarks applies to both air and space.

I'm here to tell you that we have turned a corner as far as space is concerned -- along with a broadening intellectual awareness and the beginnings of a truly aerospace doctrine, we now have a wide understanding of space operations at the 3- and 4-star level that I couldn't have claimed even 5 years ago.

The Air Force is truly committed to the leadership role in military space, and the best example of that commitment is our mission statement: "To defend the United States through control and exploitation of air and space."

Let me tell you a little about the Air Force vision for the space component of aerospace power, and how we think we're going to make that vision into reality.

### Vision

5 years ago, in 1988, we published an Air Force space policy that said we believe spacepower will one day be as decisive as airpower in armed conflict. Those were pretty ambitious words, but they carried weight because they were the product of both aviators and space operators getting together to look into the future.

We still believe those words today, and now we can think in even broader terms. While both air and space individually will be extremely important -- even critical -- in future warfare, the integrated application of aerospace power multiplies the effectiveness of both and brings a truly potent tool to the national security table.

There are two major ways space expands the capability envelope of aerospace power. One is by directly enhancing and complementing the unique characteristics of airpower that we're all familiar with -- speed, range, flexibility, precision, and lethality. Space navigation systems, for example, directly contribute to the precision and lethality of air-delivered weapons.

The other is less direct but, perhaps, just as important. And that is that space capabilities allow us to excel at some of the intangibles of war -- things like assured command and control on the local tactical battlefield and throughout the theater, like timing and synchronization in all the operational environments, and like dictating the timing and tempo of combat operations.

All of you are familiar with the concept of "information warfare" -- the idea that he who has the best grasp of the military situation at hand probably has a decisive advantage. Space provides not only the source for much of that information -- enemy force emplacement and movements, for instance -- but also the means by which we manipulate that information for best advantage within the theater.

Let me explain what I mean by talking you through some of the uses of space in a theater campaign. If we have to go fight in some corner of the world on short notice, the first thing we do is task space assets to update our knowledge of the theater.

In the not-too-distant future, that will mean implementing a canned series of taskings for new information on pre-selected sites -- targets -- in the theater. This process will be spelled out in all our OPLANS and this vital information will begin flowing to our forces and theater planners even while they're still deploying. At that point, space systems are already

beginning to dissipate some of the "fog of war" -- they are reducing the level of uncertainty our forces will have to deal with in combat.

As our forces arrive, they will deploy not a communications architecture so much as a comm terminal architecture. On-orbit systems will already be on the scene providing inter-theater and intra-theater comm. Up-to-date space-derived maps will be provided from wide-area surveillance systems -- even "soft copy" products that can be manipulated in-theater for terrain analysis or any number of other uses. And these maps and other products will already have a GPS navigation grid on them that matches to within just a few feet the real-time navigation data they receive from space on their hand-held GPS receivers. There's more of the fog and confusion of war gone -- more of the uncertainty eliminated.

As we engage the enemy, space systems will provide everybody from the theater CINC to the pilot in the cockpit with up-to-the-minute situational awareness at whatever level of detail they require. This situational awareness includes a synoptic view of the battlefield with comprehensive orders of battle, a timely high-resolution weather picture to aid targeting and a network to warn our troops and our allies of all ranges of ballistic missile attack.

We saw the beginning of that in DESERT STORM with our Constant Source links to the theater, and today we're doing technical demonstrations of concepts for putting satellite-based intelligence information straight into the cockpit. The challenge is to get the right information in a timely fashion and not inundate the pilot.

In at least one case, we're going even further than that -- we're putting space right into the weapon itself. An integrated GPS receiver on an air-to-ground missile, for example, can not only bring the weapon very accurately into range where its terminal seeker can take over, but it can relieve the seeker of its toughest long-range requirements, and therefore drive down its cost. We saw integrated GPS technology work very effectively on the SLAM -- the Stand-off Land Attack Missile -- during DESERT STORM.

I could go on and on, but you get the idea. Through space capabilities, our forces will have orders of magnitude better understanding of the combat situation that the enemy will, and can therefore exploit that advantage to the fullest.

Over the years, military scholars have come to speak of a thing called "the American way of war" -- Russell Weigley really popularized the term back in the mid-'70s with a book by that name. His focus was on bringing sufficient force to the battlefield to decisively defeat the enemy. Over time, the idea of "the American way of war" was expanded to include our ability to project superior combat power over intercontinental distances

in support of deterrence and a forward defense strategy.

Since DESERT STORM, within the DOD at least, the term "the American way of war" has been modified to encompass the idea of getting into a theater quickly with sufficient force to do the job, and getting out again with minimum casualties on both sides. That's an important new direction because it corresponds better to what the American people are coming to expect of their armed forces, and because I think you can see how both air and space fit that standard.

Getting in quickly and applying military force is an airpower job too, supplemented and enhanced by space systems. But preparing to go in -- understanding what will be there when we get there, and pre-deploying intelligence, communications, navigation, and attack warning infrastructure from a position of safety -- is a spacepower job, supplemented by airpower.

The other part of our vision for space concerns the overarching geopolitical and strategic context in which we'll have to do our aerospace force planning for the future. With a nod to my friend Colin Gray, who has a new book out on the subject, we need to have a clear appreciation for where we're going and what we're trying to accomplish at the level of national goals and objectives.

The changes we've seen in the world over the past few years are enormous, but it's not yet clear what the future equilibrium will be -- if there ever can be an equilibrium in world geopolitics. Nevertheless, some of the boundary conditions on our future forces are beginning to make themselves apparent -- smaller size, CONUS-basing, lighter and more mobile forces, etc.

Likewise, the outlines of our early 21st century strategy are taking shape -- continued nuclear deterrence (with lower force levels), continued commitment to the stability of Europe and Asia (again with lower force levels), a focus on regional interests and conflicts vice worldwide "containment" of communism, and increased concern with world economic interactions. Aerospace forces, and space forces in particular, take on new prominence under such conditions.

Space provides the nation's eyes and ears overseas, monitoring trends, anticipating crises, and building databases for national decision-makers. The importance of that grows as we pull back troops on the ground and stand down carrier battle groups.

Space enables more cost-effective air, land, and sea forces by providing the information infrastructure they need when they're called upon. It's no longer necessary to dedicate air and sealift to large amounts of communications, navigation, and intelligence equipment -- all we need to carry with us are the terminals. Reduced levels of terrestrial "capabilities in being" may be acceptable because space allows us more warning of

impending crises and more efficient and precise application of those capabilities. And space is an important U.S. contributor to coalition warfare.

As we debate "the American way of war" in the 21st century, the value of space forces is one of the clearest things we see.

### **Making the Vision Happen**

To take full advantage of space's potential, several things have to happen. First, we have to embrace military spacepower within the defense establishment and as a nation. We have to recognize its potential and consciously build a national security strategy that takes advantage of that potential.

We must continue our efforts to institutionalize space within the Air Force. Carl Builder's Masks of War provides some insights into service cultures that have a lot of truth in them. Our doctrine and our force structure reflect our corporate thinking about aerospace power, and we believe the way to get the most out of space is to first get the whole Air Force to think space. We've made some great strides in the last few years toward breaking down the barriers between air and space, but we need to keep the pressure on. We need to accelerate the cultural change within the Air Force that says we are an air and space -- a truly aerospace -- arm of military power.

General Glosson touched on education and training -- the key to making those cultural changes. An aerospace service needs an aerospace education and training program, and we have a challenge ahead of us to integrate space into all levels of our educational course material and all our exercises, from the individual unit level up through theater-wide joint force exercises. Our goal is to teach space to every airman and teach every space operator about airpower, and then to reinforce those ideas by exercising "as we intend to fight." That's fundamental to developing the space component of aerospace.

As the country's military space leader, the Air Force must spearhead the effort of building the doctrine and the aerospace power strategy to employ space capabilities, and we're well on the way to doing that. The Air Force's January '93 update to "Global Reach - Global Power" is the latest example. Our March 1992 Basic Aerospace Doctrine -- already a good foundation -- will be updated over the next two or three years to incorporate DESERT STORM lessons and our expanded vision. And we're almost ready to publish operational level doctrine for space that specifically addresses theater operations and space support to land, sea, and air combat.

Organizing for space is a subject of Chairman Powell's Roles and Missions paper -- his recommendation to the Congress was Air Force single managership for DOD space acquisition and operations. We believe there are long-term cost and operational efficiencies in that approach and the Air Force is prepared to

step up to the increased responsibility. The Chief and the senior leadership have made it clear that the Air Force is committed to being a responsible and dependable steward of America's military space program.

We are shifting emphasis within the military space community beyond acquisition and satellite operations toward theater and tactical applications for our systems. Space is being aggressively written into OPLANs worldwide, at the user's insistence.

While new applications for existing systems will certainly be our focus in the '90s, there are selected areas where we must continue to invest in modernization. Our spacelift capabilities probably lead the list. As a nation, we have come to the point where we are relying pretty much on 1950s and 1960s technology to launch our spacecraft. And it's still 1950s and '60s equipment, if we're talking about ground hardware and infrastructure. Frankly, in airplane terms, we are flying the equivalent of an F-100 into space.

We're working hard to improve that situation. We've got Congressional support for modernizing and maintaining our launch infrastructure, and we're working toward Milestone 0 within the year on a new vehicle program called Spacelifter. The Air Force has accepted the challenge of fielding a launch vehicle system on behalf of the nation -- NASA and commercial users, as well as DOD.

One of the greatest challenges we face in the Department of Defense today is what do we do about the proliferation of ballistic missiles. If there's a single lesson out of DESERT STORM that we can't afford to ignore, it's that missiles are out there and so are people who aren't afraid to use them against us.

The Air Force is working that problem from a number of angles and space is one of the keys. First we're committed to the Follow-On Early Warning System, FEWS. That's a new satellite system to replace our 20-year-old generation of missile warning satellites.

FEWS will be more sensitive in order to see theater missiles better -- they're smaller, cooler, and shorter-burning than ICBMS. It will be more discriminating in telling real threats from background and other heat sources. And it will very likely be capable of processing threat information onboard the satellite and linking it directly down to the theater, rather than to a central ground processing site and then being rebroadcast.

On the defense side, space is ultimately going to have to play in ballistic missile defense. Ground-based, terminal defense just isn't going to be adequate for very long if the threat continues to grow like we think it will. Shooting warheads down over your own territory, after they've deployed decoys and everything else, just doesn't pass the common sense

test. If I shoot a chemical warhead and disperse the contents within 50 miles of my defense, whose cause have I helped, mine or my enemy's?

Space offers a way to track missiles throughout their flight, to cue defenses, and ultimately to be the defense, or at least the first part of a layered defense. The threat is going to drive us in that direction relatively soon.

Our growing dependence on space translates into a growing need for space control. Just as we have come to recognize all the advantages of space that I ticked off, others around the world have come to same conclusions. We're well ahead of most of our potential adversaries in the use of space, but that doesn't mean space won't be used against us in the next war. There are 45 countries in the world today with space R&D programs -- more than a third of those have hardware in orbit -- and nearly every country has access to somebody's communications architecture and remote sensing database.

We must be able to control an enemy's exploitation of space in wartime. Ultimately, we need the ability to destroy his satellites, but there's much more to space control. We need to understand better how an adversary uses space, what he has access to, and where the choke points in his data flow are.

These two general ideas -- new applications for existing systems, and selective modernization of our force structure -- will allow space to hold up its end of our declared Air Force mission: "control and exploitation of space."

### Conclusion

Let me sum up and get on to your questions by saying there are two important things to keep in mind with regard to the space component of aerospace over the next 25 years. The first is that we recognize space's potential for national security -- and by "we," I mean the whole Defense Department and the Air Force in particular. The second is that the Air Force is ready to pick up the ball and run with it -- in fact we are already doing that in many, many ways.

We may just achieve our vision of making space "as decisive in combat as airpower" in the next quarter century. Perhaps not in the narrow sense of delivering iron to targets, but certainly in the sense of total impact on theater operations through force enhancement intangibles. And space, even today, is a player along with land, sea, and air forces at the strategic and political level of our national security.

Finally, an employment doctrine that stresses integrated aerospace power with well-developed air and space components is the path to getting the maximum utility out of both elements. That's the path the Air Force has set out upon, and the next 25 years will see our vision mature.

Thanks very much -- I'd be pleased to try to answer any questions you may have.

## AEROSPACE REQUIREMENTS FOR US SECURITY

Remarks for Conference

by LT GEN (ret) Wm. E. Odom

My topic today is so difficult that it actually becomes easy. No one knows how much aerospace capability the United States needs, and no one knows how to find out. That means no one can seriously challenge me as long as I talk at least a civil level of nonsense.

I open with this unremarkable, although little acknowledged, statement of the reality for a specific purpose. An audience's sense of deprivation at listening to a useless speech is relative to its expectations. If I can lower your expectations to rock bottom, you will feel less deprived. At the end of the day of a long conference with a hopeless topic I have a lot to overcome. I need every trick I can find.

Now, to be serious, I was asked to deal with the broadest aspects of the requirements issue. I have chosen two quite different dimensions of it, first, the larger political and geostrategic perspective, and second, some institutional and methodological perspectives on determining how much capability we need.

On the geo-strategic issues, three points strike me as critical for aerospace. First, the last two decades have witnessed a dramatic change in the nature of warfare that

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can be conducted by the United States. No other state, not even the old Soviet Union, has the dominance in advanced military technologies possessed by the US military. The Persian Gulf War gave us some glimpse of that reality, but far from a comprehensive view. Not only the capabilities of the fighting forces we put into the theater, but equally if not more important were things like our capacity to transport those forces halfway around the world and supply them, the technical competence of our personnel, the global nature of our C3 systems, and the overwhelming dominance of our intelligence and surveillance regime.

Before the war, the international pecking order of military powers appeared to be the US and the USSR vying for first place with a number of lesser but significant military powers. After the war, the US stood clearly in first place, and the next 15-20 places were not even occupied. I use the past tense here because our defense build-down is rapidly undercutting our dominant military power.

Even so, no other power has the potential to rival us in the next decade or so. Even a united Western Europe could not provide a trained military manpower base with a common language, the hi-tech weapons, the C3, and the space recce capabilities equal to ours. Moreover, the ground training space is not available in Europe. Japan could not match us for some of the same reasons and also different ones. Russia will not be competitive for a long time, maybe twenty years.

The point for today is clear. We have had a big military edge, and space capabilities were critical to it.

The second point concerns the likelihood of war in the future. The demise of the E-W standoff, the so-called Cold War, has actually made the world safe for Hot Wars, lots of little hot wars. There will be no shortage of wars in the future. The US should avoid many of them, but it would be unwise to ignore all of them. And virtually all cases outside the Caribbean littoral will require the US to be involved in a military coalition. Unilateral interventions may be conceivable elsewhere, but for a host of reasons, most will be either impossible or undesirable. The importance of this point lies in the fact that US aerospace and C3 capabilities make it the only state capable of truly effective coalition leadership wars. Our standard procedures from NATO take on enormous importance for coalition management elsewhere, because only there have we developed them for combined operations on a truly multi-lateral basis. To develop from scratch for each coalition action would be extremely difficult, probably impossible for timely interventions in most places. Thus NATO has a special role in this regard greatly under appreciated.

The third point concerns the interdependency of our economy with the rest of the industrialized world. Their security and economic health affects the level of income and employment in the United States. Unfortunately, this is too little recognized as the US defense budget is robbed for

domestic programs. At the same time, our military industrial and technology base is no longer autarkic. We depend on many foreign sources of supply, and we will have to do so in our time. Here is yet another reason for keeping our old security ties in NATO and East Asia.

To sum up this larger geo-strategic perspective, a new world order is desperately needed, and even if it is, wars will be numerous. Moreover, it will have to be created by the United States, based on its dramatically greater military power than any other major power. The nature of the our military technology, especially aerospace and other assets, makes us critical for leading military coalitions. We bring what no one else can, in particular, space capabilities. Will we recognize these things and take the lead in building a new world order? Or will we allow little wars to proliferate even in Europe and East Asia? I do not know the answer.

Let us suppose that indeed the US will meet this challenge. How can we be reasonably objective, in determining our aerospace requirements? I do not believe anyone has a good answer to that question today.

All of you who have worked force structure issues in the Pentagon know well that the science of sizing capabilities is not all that exact in areas we have dealt with for many decades. Commonsense, practical approaches have been worked out over time, improved incrementally with

experience and criticism. In dealing with space, we will have to proceed in a similar fashion -- looking at threats, or uncertainties and risks, making judgments about how to cope with them, and then turning those judgments into requirements that serve as the basis for R&D and procurement as well as manpower, training, and sustaining.

All I can offer today are a few ways to begin thinking about such an approach.

Let me begin with the concept of aerospace and try to relate it to missions. Until we work out the missions, no sound sense of orientation is possible.

I find the term aerospace more troublesome than helpful. Why not ground-ocean-aero-space? I sense behind this aerospace term the search for a single mission. Notice that I said missions -- plural. I cannot conceive of a single aerospace mission. Space is a place, not a mission, just as the air is a place. A wide range of missions must be performed in both. The same is true for the aero part. Many missions are performed in the air. To name a few, strategic bombing, battle interdiction, close air support, intra-theater airlift, inter-theater airlift, aircraft-based reconnaissance and intelligence missions, naval air which has a number of submissions. We are all familiar with these, and especially the perpetual turf battles about which

service performs which mission. Let me, therefore, set aside the aero-missions problem and deal primarily with the space-missions issue.

After three decades of access to space, we are still in the infancy stage of knowing how best to use it and deal with it. New missions pop up periodically. Turf quarrels are already numerous, and those connected with SPACE COMMAND are just a few. The problems in sorting all of these missions out and aligning executive responsibility for them are more complex than is often realized. The issues concern not just inter-service roles and missions. They cross into the private sector and into many more federal agencies than normally is admitted. Let me list a few of the missions now requiring access to space in some degree and then relate those missions to departmental responsibilities as they now stand in the government.

Communications. Satellite communications are used by all three military services and virtually every department in the government. The private sector common carriers play a very large role in supporting all government users. Moreover, the Def Comm Agency manages the National Communications System for the entire federal government.

This mission, of course, is only partially performed by space means. Ground based microwave systems, transoceanic

cables, troposcatter, and many other communications links are independent of satellites. Determining communications requirements, therefore, cannot be done by looking only at the space component. Fortunately, the private sector and the market force an integration of earth-based and space-based communications. Fiber-optic cables are eating into the traffic once carried by satellite. In the Defense Department, DCA and the Joint Staff are responsible for determining requirements, including the mix of earth and space paths for data flows.

Weather Forecasting is performed both on the ground, in the air, and in space. The Commerce Department runs the weather service. Thus it has a major responsibility for determining space-based weather satellite requirements. Again, it has to make the ground, air, and space trade-offs.

Intelligence depends heavily on space-based collection systems, but also on aerial and ground systems. The early centralization of the space systems in the NRO made a lot of sense. As time has passed, and as constellations of systems and their coordination with ground and aerial systems has developed, the NRO is increasing ill-placed and ill-equipped to meet the new demands. A split up and reassignment of some of these functions is essential if we are to realize more fully the potential of integrating space-based and other collection systems.

Ballistic missile defense. Because ballistic missiles of any lengthy range must travel through space, this mission naturally had a space component. Most of you know better than I the problems and possibilities with SDI efforts to develop space-based defense systems. Just let me note that in the next decade, if there is to be an operation ballistic missile defense capability deployed, much of it will be on the ground, dealing with the final part of the RV's trajectory. Thus, as with other missions in space, this one has a large ground component. Determining the size and extent of such missile defense might well be manageable by a single agency, the SPACE COMMAND. Or it might be divided between theater CINCs and the CINC SPACECOM who would have CONUS as his primary responsibility. The strategic and the theater defense missions, of course, have to be integrated with the air defense missions. Again, the space part cannot reasonably stand alone.

Scientific research has a space role. The science community has not sorted out satisfactorily all the aspects of it, however, and the turf quarrels there rival those in the Pentagon. Manned and unmanned space research require entirely different space platforms for the most part. Some research concerns space itself, astronomy, while other research is directed back at the earth. NASA, of course, formally has the lead in this mission. How to get the most

science for each dollar spent in space, not to mention deciding how much science in space is enough, bears heavily on our space programs. The military uses of space are linked in many ways to the space scientific research programs, and they enjoy the results in many instances.

Navigation has a space component. The users of such capabilities are increasing as was vividly demonstrated in the Persian Gulf War. The same is true but less noticed in the private sector. Trucking companies use space assets to keep track of vehicle locations. How many of you would have thought to include the American Trucking Associations in the list organizations with a strong interest and a significant investment in space?

I am sure that several additional missions could be identified by these are adequate for my point about space being a place in which many widely different missions and agencies are involved.

One additional mission, however, is critical to note: Space lift, that is, putting things into space. This mission cuts across virtually all of the other missions. It is a support mission for them. Who has this mission? NASA? DoD? The Air Force? The private sector? For this audience, I believe merely asking these questions makes my point. Here

is a confused mission that has yet to find a proper or satisfactory home, or even homes -- plural.

In NASA, the lift mission tends to distort and confuse the science and research missions for which it is responsible. And it also frustrates the DoD and the Intelligence Community. Getting our space lift requirements reasonably well sorted out has been extremely difficult with the present institutional arrangements.

Giving NASA the major role in space lift has made NASA primarily a space lift company, the space trucking company. That would not be a bad solution if all its other missions were taken away and if it were industrially funded, allowing anyone to buy space lift from it, negotiating the best price possible. If the Federal space trucking company, were it to exist, is allowed to go directly to Congress for funding, its customers will always get poor service. If the customers have to go to Congress to get money for buying the lift from the space lift trucking company, then it will be responsive to the customers.

I hope by now you can see where my logic is leading. Until the various space missions are sorted out among all departments, it will be difficult to sort out the military missions. And once they are sorted out, we can begin to

align responsibilities of "sizing" space requirements on a sounder basis than our present system of wild guesses.

I also believe we need an interagency director of space programs, much as the DCI manages all departments' intelligence programs, let leaves program execution to the departments.

The Vice President's Space Council potentially could perform this role. If it did, I am certain that two important things would happen.

-- First, we would discover that our space requirements are much larger than we realized, even after they are traded off, mission by mission against alternative performance of that mission on the ground, or a mix of both.

-- Second, we would have a clearer rationale for all of these various space programs, making it much easier to justify them to the Congress. The space station would probably fail to get support in such a program, but a lot of other things like the aerospace plane, brilliant eyes, etc. would.

I was repeatedly struck while in the government by the degree to which turf quarrels and flawed understanding of space capabilities paralyzed progress. We could much farther

along in knowing both how better to use space assets and how much capability makes sense. Unless some radical changes are made, we are likely to regress in space capabilities.

I have always felt sorry for the SPACE COMMAND. We do not need a space command, but we desperately need a strategic defense command which handles the space part of missile flights. Schizophrenia was to be expected, given its charter and the some of the expectations for it.

Take the aim of trying to provide regional CINCs one-point shopping for their space support. What possibly could that mean? A sensible CINC does not want space support. He wants communications support, intelligence support, weather service, navigation aid, ballistic missile defense, and so on. The one-point shopping concept presumes, if it means anything, that SPACECOM can provide all of those services. Not only is that wildly absurd. Even if SPACECOM were given all of those missions and allowed to chop off the space part of the missions of the several defense and non-defense agencies involved here, it would have no way to achieve the synergism between space and ground based capabilities, or to make efficient resource trade-offs between space and ground capabilities.

I could elaborate at length on this problem with other examples, and if you care to see some of them, then buy my

book, America's Military Revolution, which is coming out in May and read the section on space.

If I could dictate one major organizational change for the way we deal with space, it would be to create an industrially funded spacelift agency to serve military, scientific, and private sector purposes. I believe that would cause a number of improvements, ease many turf quarrels, and set in motion activities that would eventually bring other useful re-structuring.

My conclusion, overall, about how much aerospace capability we need for today and the future is that we do not know, and we are poorly organized to find out. If we were better organized to examine those needs mission by mission, I strongly believe that the justification for much larger requirements would emerge. The space business is arcane, and many mission area experts do not have the knowledge to grasp the full possibilities. And unless they are brought into the process in their areas in a meaningful way, they cannot be usefully supportive.

Let me emphasize that any assessment of the quantity of space requirements under the best conditions will remain rough guesses. Furthermore, they will be complicated by issues of quality and kind. Quality and kind will be changing because aerospace technologies are dynamic,

constantly changing. Thus the quantity and quality issues will have to be worked together, just as they are in other military capabilities.

Looking ahead at the lean budget years the Defense Department faces, I am inclined to the view that we need to keep alive a dynamic R&D effort, that we need to emphasize the quality and kinds of aerospace capabilities that can be produced. At the same time, enough of them need to be procured and used so that we can continue to learn how best to use them in support of operations.

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## FACSIMILE TRANSMISSION COVER SHEET

TO: Keith Payne

FROM: Wm. E. Odom

DATE: 12 Mar 93

TIME: 16:45

PAGES: 15 (including cover)

### MESSAGES:

Keith, Here is a draft of my remarks  
for the Aerospace Conference.  
If you have time, give me a  
subjective reaction about their  
~~appropriateness~~ appropriateness for this  
audience.

WEO

DR. ALAN GROPMAN

## HOW MUCH AEROSPACE FORCE IS ENOUGH FOR THE NEW WORLD ORDER?

Because this is an Air Force audience, I will approach the question this way: How much Air Force aerospace force is enough for the new world order? I do have some thoughts about the other services, but we are not involved in their planning, programming and budgeting processes, and have quite enough to do just bringing order out of our own chaos. We, furthermore, are not really experts on the force structure needs of the Army, Navy and Marines, as they are not authorities regarding Air Force force structure, and to ensure that prejudice does not substitute for analysis, I think it wise to comment on the Air Force alone.

Because, moreover, this is an audience of distinguished and senior Air Force officers, given to deep thinking about planning, programming and budgeting, and because, furthermore, this is an assembly of air professionals who have the responsibility to prevail in battle once called upon, I know that you are seriously engaged in force structure issues. I understand further that you are adamant in your desire to be given the force structure essential to mission success. Responsibility is sobering! Too often professional military planners are criticized by those who bear no accountability for battle outcomes. Those who are answerable to the president and American people for winning wars are often reproached for insisting on enough of the tools of war built with superior technology therein to win. I am empathetic in this regard. Because you are reflective and veteran authorities and continually deal with the force structure numbers, I can only hope to provide some food for thought regarding how to construct the answer in order to engage you in discussion, for which there is ample time permitted.

The answer to the question regarding how much aerospace force is enough is, of course, "it depends." On what does force structure hinge? Many things, certainly, but most importantly of those many elements are the following five considerations: the national security strategy; the budget; the roles and missions--really functions--assigned to the United States Air Force and other air forces and as a subsection to that Air Force doctrine--how one goes about performing the assigned missions; the size and capabilities of the other United States air forces--that is the size and capabilities of the United States Navy's air force, etc, (and potentially, given a political leadership that could make such a leap, the size and capabilities of our allies' air forces), and finally, the joint command and control doctrine governing command and control of joint air assets.

What do I mean by the last? Is the Joint Force Air Component Commander truly a commander with all the rights appertaining regarding the various United States air forces, or is he merely a coordinator of air forces, accepting for tasking purposes what the Navy, Marines and Army are willing to give him on any given day. I imply this: if the Joint Forces Air Component Commander is only a coordinator and not a commander, and in DESERT STORM he was not a commander of the joint air forces, then the Air Force force structure would probably have to be larger than it would be if he were truly a commander and able to order the air assets of

the joint forces. I suggest further, that this issue has not been resolved fully, although there has been progress in that direction.

Before elaborating on the five items just listed, let me establish some principles that guide me. The first principle is planning for uncertainty. Nobody in the governments of the World War One allies predicted in 1919, when the Versailles Treaty was initiated, what happened in 1939, when Nazi Germany invaded Poland and began a second world war. Nobody in the United States government in May 1950 predicted what happened in June 1950 in Korea. Nobody in Washington in November 1960 when John F. Kennedy was elected president predicted that seven years later there would be more than a half million American troops fighting in South Vietnam. I suggest, further, that very few in the American or even Saudi government predicted in June 1990 that Saddam Hussein would invade Kuwait on 2 August and that we would soon be involved in a major war effort. Therefore, we need to plan to be force structured for the unexpected.

Next, we in the national defense business owe our national command authorities options, we must plan to give the president alternatives. The president has to be able to deter all enemies to American interests, including, based on the first principle, ones that are unknown now. The president needs to be able to project power and to fight where and when he or she thinks it is necessary in order to secure national interests. Providing the president can convince the people through their elected representatives of who the enemy is and where the enemy is, it is not the uniformed military's place to say to the president that he or she may not send them. We can say when asked that he or she ought not to send us somewhere for various reasons, and we can ask for clear political objectives, but once the order is legally framed, we need to go. When we go, let us hope that we have the means to get there and, once there, prevail.

The third principle is planning to integrate our efforts with the other services, jointly. No United States armed service in the modern era has ever won a war by itself. Some services in some wars in the modern era, have made greater contributions than others to victories, as did the United States Air Force and air power in general during the Gulf War, but the Air Force and even air power generally did not win that war by itself. Thus to give the president options, we also must give him or her balance. If the Air Force were to win a force structure budget battle at the expense of Army or Navy capabilities, the country could be the ultimate loser.

Finally, given the nature of the world--dangerous; the character of American interests--global and multifaceted; and our role in the world--leader of the democratic states with market economies and hope for the politically or economically oppressed; this country needs a robust force projection capability. Mobility is unglamorous, but essential, and must be planned for.

Therefore plan for uncertainty, plan to give the president options, plan to balance the forces across the joint spectrum.

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and plan for mobility.

With those principles in mind, what are the foundations of force structure planning. First let us look at the national security strategy.

Admittedly, the extant National Security Strategy of the United States, George Bush's third such document is weak and inadequate guidance. There seems to be, furthermore, only the faintest beginnings in the National Security Council Staff to replace it. Nobody on the staff expects a new document before August.

The current Bush document is inferior by a wide margin to the previous two, both of which were written by Mike Hayden. Mike's pamphlets provided real guidance. In any case, we are required to look in such documents for force structure planning direction. Are we to be globally or regionally oriented? Will we still need to focus on Southwest Asia, or will we have our energy act together? Will we still be engaged on the Korean Peninsula, or will we say that 43 years of involvement is enough and Seoul can fend for itself? Etc.

The present document does direct planning for global involvement, does indicate that we should be able to fight in southwest Asia, and calls for engagement in Northeast Asia, but the instruction is flaccid. Eventually we will get better direction, we hope, or we will rely on the Chairman's National Military Strategy of the United States or whatever the Undersecretary for Defense Policy puts out as the Les Aspin version of the "Defense Planning Guidance."

If we look at president Bill Clinton's defense platform for guidance we see, among other things, a desire to pay attention to the political and economic trends in the former Soviet Union, and a declaration that the new administration will be wary of negative trends and tendencies that might cause us to enhance our preparations to fight in central Europe. The Clinton platform also calls for monitoring stress on the Korean Peninsula and also in the Middle East, says the administration will beware of ethnic tensions in the Balkans and elsewhere, and states a desire to reduce drug trafficking.

The platform, moreover, calls for the use of force when required, and unilaterally if necessary, and also announces a requirement to maintain a survivable nuclear deterrent. Finally, and there is much more in the platform, the document specifically calls for maintenance of the United States qualitative edge in its weapons systems through advanced technology. We, therefore, will be involved in the world over the next four years. The new president, we see, recognizes the possibility of our having to fight in the middle east and on the Korean peninsula, and we, therefore, must be able to maintain some kind of presence, and be able to project enough power to both regions to succeed. There is no necessity to speak more of the obvious, but I want to make this point: whether it is implicit or explicit, the national security strategy is at the apex of the force structure planning process. While the interests of the United States are for

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planning purposes nearly eternal, presidents establish the strategy either explicitly or implicitly and we cannot force structure in opposition to the president's strategy.

The second force structure basis is the budget. If the budget were expanding instead of contracting we would not be having this meeting. Serious force structure decisions had to be made in 1947, 1948, 1949 and early 1950 because of severe budget cuts. One Air Force chief of staff resigned in that era because he was asked to make cuts in force structure that he considered dangerous or at least unwise. The Navy and the Air Force were embroiled in a terrible clash because of budget stringency that led to the so called revolt of the admirals, which is viewed diametrically by the Air Force and Navy. The Air Force sees the admirals as having acted parochially and against the national interest, and the Navy thinks of the revolting admirals as heroes. This budget war between the Navy and Air Force also resulted in the dismissal of a chief of naval operations. The Korean War/Cold War build up and the necessity to fight the Korean war, led to an armistice between the Navy and the Air Force which is still in effect.

Were the budget to be cut severely, choices might have to be made regarding functions that the you might consider muscle and bone rather than fat. Right now we can foresee a budget authority for next year of somewhere between \$275.5 billion, the Bush base force, and \$263.7 billion, the Clinton proposal. I would not anticipate such if any of an Air Force force structure cut even if the lower Clinton figure were to come to fruit, but if the Congress or the administration decided to really slash the budget, say cut it by 50 percent instead of 20 percent over the next five years, major decisions would have to be made, and perhaps the Air Force would have to give up some of its force projection capability to maintain its punch, or vice versa in order to guarantee getting there.

The budget matters and I would think that prudence demands that a strictly in house range of force structure budgets be kept in some flag officer's safe in order to have well thought out and analyzed answers if and when the really tough budget questions are asked. In other words, given the national interests, the likely threats to those interests, the potential national security and military strategies, this is the Air Force force structure we would need to perform our assigned missions given an Army, Navy and Marine Corps of such and such a size. Dollars, then, are a driver in terms of more than the numbers of souls on board and the number of extra bases closed, or the fraction of the force structure in the reserves or guard. Limited dollars might mean dropping an entire function or even more than one. Or it might mean leaving an area of the world that some consider important, but no one considers vital. If the budget were cut dramatically, say in half over the next five years, we might be forced to leave Korea or thin out the forces even more than they are planned to be thinned in Europe, or leave Europe all together.

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The third element that force structure depends upon is roles and missions or better put, functions. Last month the chairman released his memorandum for the secretary of defense on roles, missions and functions. He called the manuscript a nonconsensus document. In it General Powell makes changes at the margin, for which some people, notably Senator Sam Nunn, are at least mildly disappointed. This document is certainly not the last word on the subject. I don't know where this battle will end, but obviously if the Air Force drops some function or has one transferred, then force structure would change. If for example the Air Force were to lose responsibility for close air support, it would need no A-10s and the command and control assets could be changed too. If the air defense role is to be handled by all air forces, then the United States Air Force needs fewer interceptors. Nothing much needs to be said here except that this needs to be worked out, and the president is interested in engaging in a roles and missions discussion. We know that Senator Nunn is too. This is of great concern to all of you and really the heart of this debate, whether in the Pentagon or on the Hill, is aviation.

I think, for whatever it is worth, that the Air Force should be responsible for the roles and missions it is accountable for now in the Unified Actions Armed Forces and the relevant Department of Defense documents, because air is the specialty of the Air Force and that service takes the broadest view of airpower. The Army does not take aviation as seriously as does the Air Force, and, for that and other reasons, should not be responsible for close air support because the Air Force will do it better. In terms of professional viewpoint, skill, maintenance, and air crew professionalism, the Air Force deserves the mission, and because of Air Force doctrine, one gets more flexibility out of air assets in the Air Force than one gets out of air assets in the Army.

The Marines, moreover, see aviation as flying artillery--in other words, in a limited manner, as an auxiliary. Neither the Marines nor the Army would fully exploit the inherent flexibility of air power. The idea of using close air support assets in either service in a strategic manner is beyond the vision of either service. For all of that, however, a major change in Air Force missions, however it came about, voluntarily or involuntarily, would affect Air Force force structure, therefore the roles and missions debate which is now being shaped is important to the force structure size issue.

Doctrine, the ways one goes about performing the assigned missions, also plays a role in determining the size and shape of the various elements in the force structure. The Army Air Forces of World War II were very differently force structured than is the Air Force today. The strategic bombing doctrine that was taught at the Air Corps Tactical School called for superior bombers and initially permitted fighters to be less than superior because the bombers were the war winners. If they were armed properly and if flown in daylight at high altitude in the proper

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formations for defensive purposes as well as for bombing concentration, bombers could win wars by themselves. The most built airplane in World War II was the B-24 (about 18,000 of them). Name the American World War II Warthog, or Stuka, or in December 1941 the Army Air Forces Eagle. The doctrine was different and therefore the force structure was different. One would force structure differently for an air force that saw its primary approach to gaining air superiority as a defensive counter air effort versus an offensive counter air endeavor.

Regardless of how the roles and missions debate comes out, and notwithstanding the explicit or implicit doctrine for forces employment, the shape and size of the Air Force's force structure depends in part, or it should depend in part on the size, shape and qualities of the Army's, Navy's and Marine's air forces. Because air power is flexible--any service's air power--there always will be an element of redundancy. In the interests of reducing redundancies, the number of F-15s and F-16s should be or at least could be related to the number of F-14s and F-18s. The number of A-10s or A-16s should be or could be related to the number of AV-8Bs, A-6s, A-7s, A-18s, and Apache's. One could argue, furthermore, as we have with our allies, that it is not necessary for the United States Air Force to duplicate force capabilities that are abundant in our allies, but I don't want to get into that.

I do not need to go on. The larger the Navy's Air Force, Marines' Air Force, Army's Air Force, theoretically the smaller the size of the United States Air Force. I say theoretically, because the size and shape of the Air Force force structure can only be based on the size and shape of the other United States air forces if there is a joint command and control doctrine that permits employment of the joint air forces in a manner that exploits their flexibility. Which brings us to our last point: the efficacy of the Joint Force Air Component Commander.

If the Joint Force Air Component Commander is truly a commander, then one can foresee a smaller United States Air Force (always maintaining, of course, the unique Air Force function and capability for long range strategic attack) because the joint air component commander will be able to task the air forces of the Army, Navy and Marine Corps in the interests of the theater commander in chief's strategy. However, if the last word in the title is coordinator as the Marines insist he was during DESERT STORM and insists he ought to be, then the Air Force force structure might have to be larger. If the Navy insists on route packs and the right to withhold on any day anything and everything that flies, as they could have in Operation DESERT STORM, if the Marine Corps withholds half or more of its airfleet, as it did in DESERT STORM, even when there was virtually no Marine ground maneuvers on going, if the Army withholds nearly everything, as it did in DESERT STORM, then one cannot trim the force as such as one might.

This is an emotional subject among professionals. It needs to be resolved in favor of the theater commander, however,

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because the force structure is being reduced, there will be fewer aircraft in everybody's force structure, there will be fewer types of aircraft too. The main reason the DESERT STORM joint force air component commander did not insist on the fullest reality of the definition of the joint force air component commander is that he had, certainly by October 1990, all the Air Force aircraft he thought he could handle and all that he needed to do the job that the theater commander and national command authorities asked of him. He could, therefore, let the Marines, Navy and Army do their thing, husband their forces, schedule proposed missions to tie up their forces, etc, because the Air Force contingent was robust indeed. He, furthermore, had no time for the pain of the argument, given his enormous responsibilities. Saudi Arabia in January 1991 was no place for solving a doctrinal dispute that has been around for forty years. However, it may be essential to have this controversy fully resolved before DESERT STORM II in 1997 when the Air Force is approaching half its 1990 size, when the Navy has nine carriers and the Marines fewer air wings.

Look back at the week after 2 August 1990 when only air power could have made a difference and recognize that there was not abundant Air Force air power on the scene then. We do not need to paper over this dispute because DESERT STORM was a great military victory.

We in the Air Force must be sensitive to the combined forces doctrine of the Marine Corps, as I know General McPeak is. We must recognize that the Marines are deliberately light on armor and artillery in order to make them more mobile and their air is essential to their operation, therefore they jealously guard it. The Marines air ground team is exceptionally effective and we must be very of interjecting ourselves into a marriage that has worked and is working.

Similarly with the Navy's air. The aircraft carrier is the navy's capital ship. Its air is the means the Navy employs for controlling the seas, and for projecting power. Air is also central to their defense against the air, surface or subsurface threats. We do not have the experience that comes with a professional lifetime of sea employment to treat these needs trivially.

Similarly with the Army. We must be equally sensitive to their air support concerns, and understand how integrated their armed helicopter and ground maneuver forces are.

But it is legitimate to ask if Marine air arrives before the Marine ground forces, can it sit out the air battle if that is the only war at the time? Are the Marines allowed to schedule their forces deployment in such a way that the question of using early arriving Marine Air is moot? If there is no serious threat to naval forces for which their air is an antidote, is the Navy permitted to husband their air. Is the Navy permitted to run route packs during the air campaign because it does not want to submit to the command of the joint force air component commander? When does the Navy, Marine Corps, and Army fight the theater commander's operational battle and not their own as they see it?

The answer to those questions have force structure implications in an era of stringent drawdown. Are we prepared to settle this issue? I recognize the progress on this matter made because of the Chairman's statement of 23 November 1992 on doctrine for selected joint operational concepts, but I also know that many in the air staff are not satisfied with the doctrine as it stands.

What then are the United States air forces required for the new world order? None of what I say next will be new to you and none of it needs to take much time. We need mobility to project our force--C-17s and C-5s to get the forces there, C-130s and C-17s to move them around the theater, and tankers to move the fighters, bombers and airlifters. We need stealthy fighters and bombers because we cannot afford to lose substantial amounts of the force structure because it is expensive and limited in numbers and the production facilities sparse. We need auxiliary aircraft to ensure that nonstealthy aircraft like the F-15s and F-16s are protected. We need brilliant navigation systems and munitions to find the target unerringly and to kill targets on the first pass, and from a stand off range. We need sensor fused weapons to stop armored attacks wholesale rather than retail. We need airborne command and control aircraft and airborne surveillance, tracking and reconnaissance aircraft to multiply the effectiveness of our force, especially as our numbers become smaller.

Regarding numbers? Given a turbulent world, but one without a Soviet Union-like adversary, if we are forced to plan to fight in two widely separated regions simultaneously, we can live with the base force and probably some significant fraction of that force providing the other air forces are robust and air power can be employed to satisfy the theater commander's mission.

The numbers in the Rand Corporation briefing on the "New Calculus" that began this day are based on an examination of likely national security strategy and are grounded on computer simulations. The air forces force structure the Rand authors sent to the middle eastern contingency would win in DESERT STORM fashion--relatively rapidly and with relatively low friendly losses, if the adversary did not learn some lessons from that previous war. The report, moreover, assumes that Marine Air and Navy air is fully usable, an unwarranted assumption to my way of thinking, and it omits detail regarding Army air. However, ten fighter wings of F-15Cs, F-15Es, F-111Fs, F-16Cs, F-117s, EF-111s, armed with technologically superior weapons, and on bases that are defended by Patriots and other defensive systems should do the job and leave enough Air Force to fight in Korea simultaneously.

The approach taken by Rand--that is using simulations to determine if the force structure would prevail--has long been used by various Air Force analytic entities and is sound. The Rand draft is not an answer to the question any more than my briefing is--it is useful to you as an approach to determining force structure.

To do that we must recognize that the future is uncertain

and because it is unpredictable we must provide the president with options by insisting on balanced forces since no one can predict the future and no service by itself has won a war in the modern era, and is not expected to in the future. We must ensure a robust force projection capability because of our interests, needs, values and the nature of the unforeseeable future.

When calculating our force structure needs we must consider the national long term strategy; the likely budget, the roles and missions assigned to the Air Force, the size and capabilities of the air forces of our sister services, and, finally, how the joint air forces are commanded and controlled.

Unquestionably air power has become more significant over the length of the 20th century and in the Persian Gulf War it was dominant and decisive. We need to learn the correct lessons from that war in order to apply them to future wars. We need to see the military victory accurately and ensure that all of the air power shortcomings are examined fully. If we fight the battles today that remained unresolved by the Gulf War we could produce a smarter force structure for the new world order.

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## AGENDA/PRESENTATION TOPICS

### Aerospace Power's Role in American National Security in the Next Quarter Century

Over the past half century air and recently space forces have made an ever increasing contribution to U.S. military power. Recent technical advances and the remarkable achievements of aerospace power in the Gulf war indicate that the potential of U.S. aerospace power as a source of relative advantage in international competition may be increasing faster than it ever has before. Coupled with undeniable current and prospective pressure on U.S. military force size and resources, this observation implies a new look at U.S. military posture to develop a clearer picture of what the United States can and should ask of aerospace forces as a centerpiece of the American national security establishment over the next quarter century.

### WELCOME AND CHARGE TO THE CONFERENCE

Lieutenant General Buster C. Glosson, DCS Plans, HQ USAF

### FIRST SESSION

**What Aerospace Lessons should We Carry into the Future from the Gulf War?**

What should we embrace as lessons learned from the Gulf War: the United States' first post-Cold War conflict and the first "Space War"? How should these lessons shape future U.S. military forces in general and U.S. aerospace forces in particular? To what extent is the future applicability of Gulf War experience limited by uniqueness of that event or on-going processes that place in doubt the degree to which "lessons" of the war will have future relevance?

Colonel John A. Warden III, Commander, Air Command and Staff College

**What are the Long-Term Lessons of Aerospace History that Deserve a Leading Role in Determining How We Define our Aerospace Futures?**

What are the enduring lessons about aerospace power that the Air Force should distill from history and carry into the next quarter century? For the first decades of its history U.S. airpower strained but could not live up to the promises made by its theorists. Then it came progressively closer; and now with the Gulf War it has produced what it so long promised. How should the U.S. armed forces apply the lessons of history to go even further in assuring strategic return for the nation's investment in aerospace forces?

Professor Sam Gardiner, Independent Consultant on Warfare and Operational Art

### SECOND SESSION

**The Direction and Pace of Aerospace Technology**

What should we anticipate from aerospace technology over the next twenty-five years. What relevant areas will develop the farthest and fastest? What will lag? What developments will have the greatest relevance to national security issues? What should the United States/United States Air Force do to affect anticipated development patterns? How broad will aerospace become; for example the first anti-ballistic-missile operations occurred during the Gulf War. What should we expect in terms of developments in this area over the next twenty-five years, and what are the appropriate service and national policy positions with regard to establishing within the purview of aerospace such capabilities with significant potential for American national security?

Dr. Raymond S. Colladay, Vice President, Strategic Defense Systems, Martin Marietta

**Industrial Base, U.S. Relative Advantage, and the Future of U.S. Aerospace Power: Converting Economic Potential into Military Power**

How well can the U.S. industrial base support future military requirements of the United States? How do aerospace forces compare with other forces in this regard? What does this imply for the future configuration of U.S. military forces? What does it imply for U.S. Government relations with aerospace/defense industry?

Speaker #1: Mr. Dick Hardy, Vice President and General Manager, Boeing Military Airplane Division,  
Boeing Defense and Space Group

Speaker #2: Dr. Ronald Sugar, Vice President, Group Development, Space and Electronics, TRW

### KEYNOTE LUNCHEON SPEAKER

**What are the Aerospace Implications of the On-going "Roles and Missions" Review?**

Concern has been voiced over the apparent duplication inherent in separate aerospace operations by each of the several services. As resources and forces shrink, organizational change will follow. How should the

services respond to this criticism? What changes should be made/resisted? What should U.S. military organization, particularly with respect to aerospace forces, look like in the coming decades?

General Michael P.C. Carns, Vice Chief of Staff of the Air Force

### THIRD SESSION

#### **Preparing for the Next War**

However often one hears that the world is in a post-war period, truth for the U.S. military establishment is that, in the long run, the United States is in an inter-war period. This realization carries with it the responsibility for preparing aerospace forces, their organizations, people, and materiel for future conflict. What should the aerospace capability of the United States contribute in wars of the future; how should it prepare itself; and how should the U.S. armed forces, particularly the Air Force, go about this task?

Lieutenant General Buster C. Glosson, DCS Plans, HQ USAF

#### **How Should the Services Fit "Space" into "Aerospace" over the Next Twenty-Five Years?**

Past Air Force experience has heavily favored the air dimension of aerospace. As we learned in the Gulf War, space systems and operations have arrived as an important part of U.S. military power. How should the Services in general, and the U.S. Air Force in particular undertake the organizational and operational changes needed to insure the maximum overall military advantage from U.S. space capabilities?

Lieutenant General Thomas Moorman, Vice Commander, AF Space Command

### FOURTH SESSION

#### **How Much Aerospace Force is Enough for the New World "Order"?**

What do tomorrow's strategic challenges imply for the quality and quantity of U.S. military forces in general and U.S. aerospace power in particular? This question will be addressed by two speakers, one from the broad policy, strategy viewpoint, the second from a more constrained defense and military perspective.

Speaker #1: Lt. Gen. William E. Odom, USA (Ret.), Director of National Security Studies, Hudson Institute; former Director of the National Security Agency; and former Assistant Chief of Staff for Intelligence, Headquarters, U.S. Army

Speaker #2: Dr. Alan Gropman, Industrial College of the Armed Forces Faculty

### SUMMATION AND CLOSING

Dr. Colin S. Gray, President, National Security Research, Inc.

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#### **Conference Schedule**

0800-0900 .....Registration	1235-1400 .....Lunch
0815-0845 .....Optional Rand Briefing	1400-1525 .....Session #3
0900-0915 .....Introduction & Charge to Conferees	1525-1535 .....Break
0915-1040 .....Session #1	1535-1700 .....Session #4
1040-1050 .....Break	1700-1710 .....Conference Summation/Closing
1050-1235 .....Session #2	

#### **Location:**

Crystal Gateway Marriott Hotel  
1700 Jefferson Davis Highway  
Arlington, VA 22202  
(703) 920-3230

#### **Date:**

Tuesday, March 16, 1993

#### **Schedule of Events:**

NOTE: Sessions will include 30 minutes for presentation of each of two papers (three papers in session two) and 25 minutes for discussion of those papers and related topics. Luncheon address will be 30 minutes long, from 1320 to 1350.

**Aerospace Power's Role in American National Security in the Next Quarter Century**

**OPTIONAL BRIEFING**

**0815-0845**

**THE NEW CALCULUS:  
ANALYZING AIRPOWER'S CHANGING ROLE IN  
JOINT THEATER CAMPAIGNS**

**Presented courtesy of the Rand Corporation and the Directorate of Plans  
by Mr. Fred Frostic**

# **AEROSPACE POWER'S ROLE IN AMERICAN NATIONAL SECURITY CONFERENCE**

## **ATTENDEE LIST**

**MARCH 16, 1993**

**Col Jeff Barnett**  
**Strategic Planning Division**

**Dr. Donald R. Baucom**  
**Command Historian**  
**SDIO**

**Lt. Col. Price T. Bingham, USAF (Ret.)**  
**Airpower Analyst and Author**

**Mr. John Boatman**  
**Jane's Defense Weekly**

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**Mr. Joseph A. Breen**  
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**B Gen James L. Cole**  
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**Congressional Research Service**

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**Mr. Sam Fishbein**  
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**Flight Management Systems**  
**National Air & Space Museum**

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**HQ Air Mobility Command**

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**President**  
**Knowledge Implementation Corporation**

**Mr. Frederick L. Frostic**  
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**Mr. David Fulghum**  
Aviation Week and Space Technology

**Professor Sam Gardiner**  
Independent Consultant  
Operational Art & Theater Warfare

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**Col Bruce Gillett**  
Chief  
Combat Forces Requirements Division

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National War College

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SRS Technologies

**Mr. Dick Hardy**  
Vice President & General Manager  
Boeing Military Airplane Division  
Boeing Defense & Space Group

**Col Dale Hill**  
SAF Manpower and Installations

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Under Secretary of Defense (Acquisition)

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Former Commander  
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